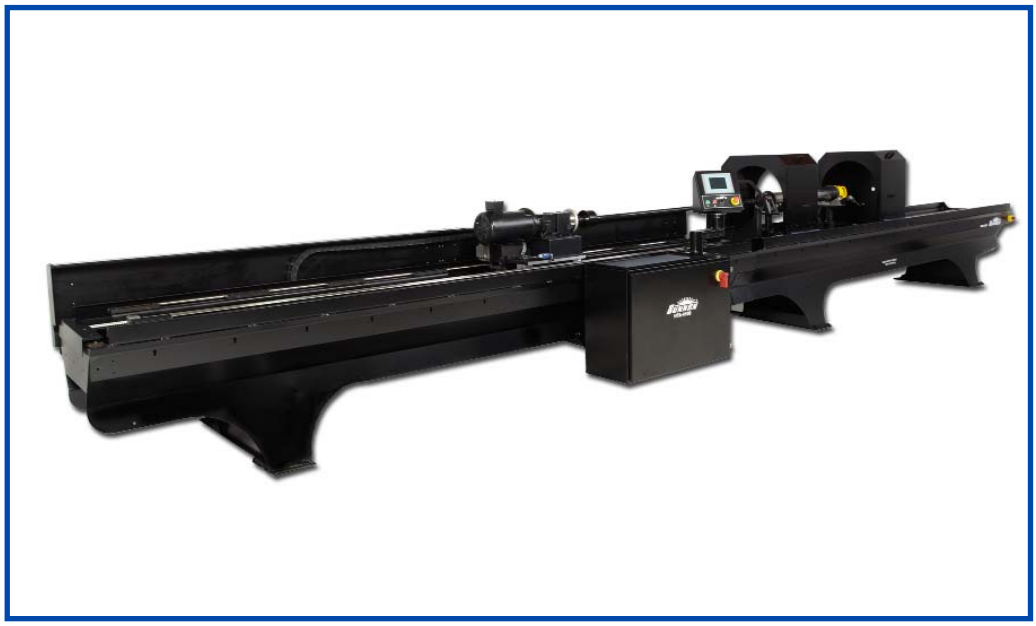
ORIGINAL INSTRUCTIONS

Installation, Setup and Operation

INSTRUCTIONS



for

SUNNEN® TUBE HONE

Model: HTA-2100 & HTA-4100

READ THE FOLLOWING INSTRUCTIONS THOROUGHLY AND CAREFULLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THE SUNNEN® TUBE HONE.

"SUNNEN® AND THE SUNNEN LOGO ARE REGISTERED TRADEMARKS OF SUNNEN PRODUCTS COMPANY."

SUNNEN® PRODUCTS COMPANY • 7910 MANCHESTER ROAD • ST. LOUIS, MO 63143, U.S.A. • PHONE: 314-781-2100

GENERAL INFORMATION

The Sunnen® equipment has been designed and engineered for a wide variety of parts within the capacity and limitation of the equipment. With proper care and maintenance this equipment will give years of service.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY AND THOROUGHLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THIS EQUIPMENT.

IMPORTANT: Read any supplemental instructions BEFORE installing this equipment. These supplemental instructions give you important information to assist you with the planning and installation of your Sunnen equipment.

Sunnen Technical Service Department is available to provide telephone assistance for installation, programming, & troubleshooting of your Sunnen equipment. All support is available during normal business hours, 8:00 AM to 4:30 PM Central Time.

Review all literature provided with your Sunnen equipment. This literature provides valuable information for proper installation, operation, and maintenance of your equipment. Troubleshooting information can also be found within the Instructions. If you cannot find what you need, call for technical support.

Where applicable, programming information for your Sunnen equipment is also included. Most answers can be found in the literature packaged with your equipment.

Help us help you. When ordering parts, requesting information, or technical assistance about your equipment, please have the following information available:

- Have ALL MANUALS on hand. The Customer Services Representative or Technician will refer to it.
- Have Model Number and Serial Number printed on your equipment Specification Nameplate.
- Where Applicable: Have Drive model and all nameplate data. Motor type, brand, and all nameplate data.

For Troubleshooting, additional information may be required:

- Power distribution information (type - delta, wye, power factor correction; other major switching devices used, voltage fluctuations)
- Installation Wiring (separation of power & control wire; wire type/class used, distance between drive and motor, grounding).
- Use of any optional devices/equipment between the Drive & motor (output chokes, etc.).

For fast service on your orders call:

Sunnen Automotive Customer Service toll free at: 1-800-772-2878
Sunnen Industrial Customer Service toll free at: 1-800-325-3670
Customers outside the USA, contact your local authorized Sunnen Distributor.
Additional information available at: http://www.sunnen.com or e-mail: sunnen@sunnen.com

NOTE: Sunnen reserves the right to change or revise specifications and product design in connection with any feature of our products contained herein. Such changes do not entitle the buyer to corresponding changes, improvements, additions, or replacements for equipment, supplies or accessories previously sold. Information contained herein is considered to be accurate based on available information at the time of printing. Should any discrepancy of information arise, Sunnen recommends that user verify the discrepancy with Sunnen before proceeding.

ESD PREVENTION REVIEW

Let's review the basics of a sound static control system and its effective implementation. First, in the three step plan:

1. Always ground yourself when handling sensitive components or assemblies.
2. Always use a conductive or shielded container during storage or transportation. These materials create a Faraday cage which will isolate the contents from static charges.
3. Open ESD safe containers only at a static safe work station.

At the static safe work station, follow these procedures before beginning any work:

A. Put on your wrist strap or foot grounding devices.

B. Check all grounding cords to make sure they are properly connected to ground, ensuring the effective dissipation of static charges.

C. Make sure that your work surface is clean and clear of unnecessary materials, particularly common plastics.

D. Anti-static bubble wrap has been included for use at the machine when an ESD safe workstation is not available.

You are now properly grounded and ready to begin work. Following these few simple rules and using a little common sense will go a long way toward helping you and your company in the battle against the hazards of static electricity. When you are working with ESD sensitive devices, make sure you:

GROUND

ISOLATE

NEUTRALIZE

SUNNEN® LIMITED PRODUCT WARRANTY

Sunnen® Products Company and its subsidiaries (SPC) warrant that all new SPC honing machines, gaging equipment, tooling, and related equipment will be free of defects in material and/or workmanship for a period of one year from the date of original shipment from SPC.

Upon prompt notification of a defect during the one-year period, SPC will repair, replace, or refund the purchase price, with respect to parts that prove to be defective (as defined above). Any equipment or tooling which is found to be defective from improper use will be returned at the customer's cost or repaired (if possible) at customer's request. Customer shall be charged current rates for all such repair.

Prior to returning any SPC product, an authorization (RMA#) and shipping instructions must be obtained from the Customer Service Department or items sent to SPC will be returned to the customer.

Warranty Limitations and Exclusions This Warranty does not apply to the following:

- Normal maintenance items subject to wear and tear: (belts, fuses, filters, etc).
- Damages resulting from but not limited to:
  - › Shipment to the customer (for items delivered to customer or customer's agent F.O.B., Shipping Point)
  - › Incorrect installation including improper lifting, dropping and/or placement
  - › Incorrect electric power (beyond +/- 10% of rated voltage) including intermittent or random voltage spikes or drops
  - › Incorrect air supply volume and/or pressure and/or contaminated air supply
  - › Electromagnetic or radio frequency interference from surrounding equipment (EMI, RFI)
  - › Storm, lightning, flood or fire damage
  - › Failure to perform regular maintenance as outlined in SPC manuals
  - › Improper machine setup or operation causing a crash to occur
  - › Misapplication of the equipment
  - › Use of non-SPC machines, tooling, abrasive, fixturing, coolant, repair parts, or filtration
  - › Incorrect software installation and/or misuse
  - › Non-authorized customer installed electronics and/or software
  - › Customer modifications to SPC software

THE LIMITED WARRANTY DESCRIBED HEREIN IS EXPRESSLY IN LIEU OF ALL ANY OTHER WARRANTIES. SPC MAKES NO REPRESENTATION OR WARRANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, WHETHER AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER MATTER. SPC IS NOT RESPONSIBLE FOR THE IMPROPER USE OF ANY OF ITS PRODUCTS. SPC SHALL NOT BE LIABLE FOR DIRECT, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO: LOSS OF USE, REVENUE, OR PROFIT. SPC ASSUMES NO LIABILITY FOR PURCHASED ITEMS PRODUCED BY OTHER MANUFACTURERS WHO EXTEND SEPARATE WARRANTIES. REGARDLESS OF ANY RIGHTS AFFORDED BY LAW TO BUYER, SPC's LIABILITY, IF ANY, FOR ANY AND ALL CLAIMS FOR LOSS OR DAMAGES WITH RESPECT TO THE PRODUCTS, AND BUYER'S SOLE AND EXCLUSIVE REMEDY THEREFORE, SHALL IN ALL EVENTS BE LIMITED IN AMOUNT TO THE PURCHASE PRICE OF THAT PORTION OF THE PRODUCTS WITH RESPECT TO WHICH A VALID CLAIM IS MADE.

Shipping Damages

Except in the case of F.O.B., Buyer's destination shipments, SPC will not be liable for any settlement claims for obvious and/or concealed shipping damages. The customer bears the responsibility to unpack all shipments immediately and inspect for damage. When obvious and/or concealed damage is found, the customer must immediately notify the carrier's agent to make an inspection and file a claim. The customer should retain the shipping container and packing material.

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Any alteration or reverse engineering of the software is expressly forbidden and is in violation of this agreement.

SPC reserves the right to update the software covered by this agreement at any time without prior notice and any such updates are covered by this agreement.

SAFETY INSTRUCTIONS

READ FIRST

This machine, like any equipment, may be dangerous if used improperly. Please read all warnings and instructions before attempting to use this machine.

Always disconnect power at main enclosure before servicing machine.[1]

Always wear eye protection when operating this machine.

NEVER open or remove any machine cover or protective guard with power "ON." Always disconnect power at main enclosure before servicing this equipment.[1]

DO NOT attempt any repair or maintenance procedure beyond those described in this book. Contact your Sunnen® Field Service Engineer or Technical Services Representative for repairs not covered in these instructions.

Due to the wide variety of machine configurations, all possibilities cannot be described in these instructions. Instructions for safe use and maintenance of optional equipment ordered through Sunnen, will be provided through separate documentation and/or training provided by your Sunnen Field Service Engineer or Technical Services Representative.

DO NOT attempt to defeat any safety device on this machine or on any of the optional equipment.

If specially built automation components are added to this system, be sure that safety is not compromised. If necessary, obtain special enlarged work area safety system from Sunnen Products Co.

[1] DO NOT touch electrical components until main input power has been turned off and *CHARGE* lamps are extinguished. WARNING: The capacitors are still charged and can be quite dangerous.

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INTRODUCTION

This Instruction Manual is provided to give the information required to install, operate, and maintain the Sunnen® HTA-Series Tube Hones, models HTA-2100 & -4100.

As there are numerous Workpieces that can be honed on this machine, all possible combinations cannot be discussed here. The determining factor as to whether a particular part or material can be honed in the machine will come with experience from working with the machine in your shop.

When ordering parts for, or requesting information about your machine, include the serial number of your machine.

READ THE FOLLOWING INSTRUCTION THOROUGHLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THE SUNNEN® TUBE HONE.

GENERAL INFORMATION & SPECIFICATIONS

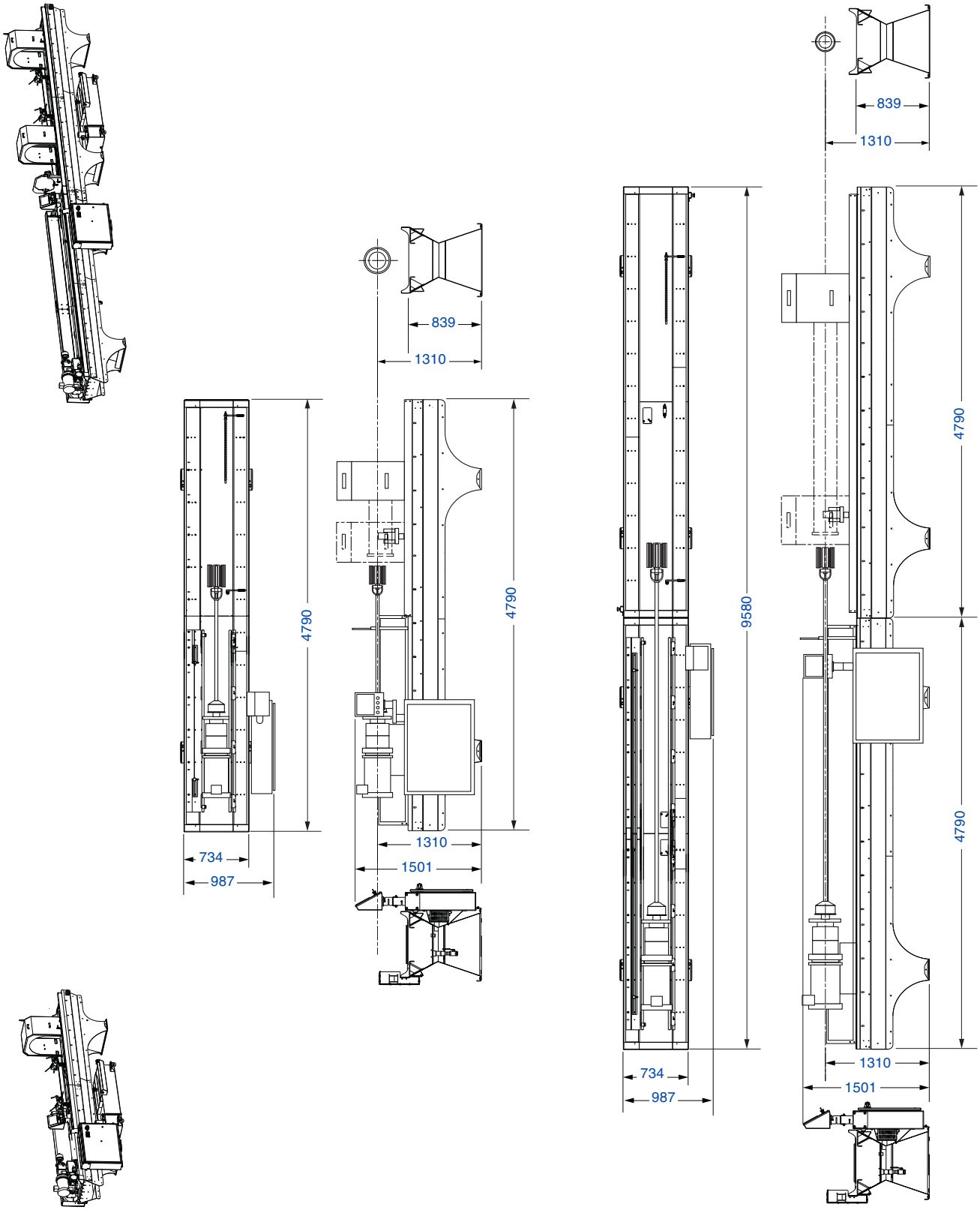
Sunnen® Tube Hone - HTA-Series

Model:	HTA-2100	HTA-4100
Workpiece Ø Range (ID)[1]:	64 - 533 mm (2.5 - 21 in.)[2]	
Workpiece Ø Range (OD)[1]:	38 - 610 mm (1.5 - 24 in.)[2]	
Workpiece Weight[1]:	3630 kg (8000 lbs.)	
Stroke Length Range[1]:	Up to 2,1 m (6.9 ft / 82.7 in.)	Up to 4,1 m (13.5 ft / 161.4 in.)
Stroke Rate:	1,52 - 27,4 mpm (5 - 90 fpm)	
Stroke Motor:	1,48 kW (2 hp)	
Spindle Speeds:	20 to 300 rpm	
Spindle Motor:	2,24 kW (3 hp) AC gear motor	
Set-Up Time:	10 - 15 min.	
Stock Removal Rate[3]:	130 cm^3/hr (8 in^3/hr)	
Coolant Pump:	Centrifugal pump	
Pump Motor:	0,248 kW (1/3 hp)	
Coolant Capacity:	182 L (48 gal.)	
Pump Rate:	225 LPM (60 GPM)	
Coolant Requirements:	Sunnen Industrial Honing Fluids	
Controls:	Siemens PLC with Touch Screen	
Floor Space -		
Length:	4790 mm (189 in.)	9580 mm (385 in.)
Depth:	987 mm (39 in.)	987 mm (39 in.)
Height:	1501mm (59 in.)	1501 mm (59 in.)
Floor Weight (Dry):	1088 kg (2400 lbs.)	1815 kg (4100 lbs.)
Floor Load:	739 kg/sq. meter (151 lbs./sq. ft)	
Electrical Requirements:	400/460V, 50/60Hz, 3Ph, 15A (Designed in accordance with NEC/NFPA 79)	
Color:	Black	
Noise Emission:	Less than 76 dB(A) continuous Load (max. noise) condition in a typical factory environment.	Less than 78 dB(A) peak

[1] Diameter range, length range, and workpiece weight are contingent on workpiece and application.

[2] For diameter sizes below 64mm (2.5in.), contact your local Sunnen Field Service Engineer.

[3] For steel material with conventional abrasives. Actual stock removal rates will vary depending on workpiece and application.



FLOOR PLAN - Sunnen® Tube Hones

SECTION 1
INSTALLATION

PURPOSE

This Section is designed to aid user in unpacking, inspecting, and installing Sunnen® Tube Hone, models HTA-2100 & -4100. Hereafter, referred to as the Machine *(see Figure 1-1)*.

TOOLS & MATERIALS

The following tools and materials are required for unpacking and installing machine:

Wire Cutters/Strippers	Knife
Screw Driver (Std. nose)	Hammer
Slip-Joint Pliers	Crow Bar
Cleaning Solvent	Tin Snips
Open End Wrench (17, 19, & 24 mm / 3/4in.)	

INSTALLATION

Read the following instructions carefully and thoroughly before unpacking, inspecting, and installing the Machine. All references to right and left in these instructions are, unless otherwise noted, as seen by operator as one looks at Machine or assembly being described.

1. Remove heavy duty plastic wrap from around shipping crate.

WARNING

Use safety glasses or goggles when cutting bands.

2. Cut, remove and discard shipping bands.

3. Remove Components from crate.

4. Remove items shipped inside Coolant Reservoir.

5. Remove nuts and bolts securing Base(s) to bottom of crate(s); use 3/4" Open End Wrench.

6. Using a fork lift. Remove Base(s) from skid and set it in place, as follows:

FIGURE 1-1, Tube Hone

- *HTA-2100 ONLY*:

a. Machine Base should be lifted in center of Base, from either front or back side *(see Figure 1-2)*.

b. Using a machinist level, level machine by adjusting Leveling Setscrews in Support feet, using a 1-1/8 Open End Wrench *(see Figure 1-4)*.

- *HTA-4100 ONLY*:

a. Carriage Base should be lifted in center of Base, from either front or back side *(see Figure 1-2)*. Then Workpiece Base should be lifted in center of Base, and set it in line with Carriage Base *(see Figure 1-3)*.

b. Remove Cover Plate *(see Figure 1-5)*.

NOTE: If needed: Refer to I-HTA-555, Special Instructions for cover removal.

c. Slide two sections together.

d. Utilizing a string or wire, align operator side of both Workpiece & Carriage Bases *(refer to Figure 1-3)*.

e. Using a machinist level, level Carriage Base by adjusting Leveling Setscrews in Support feet, using a 1-1/8 Open End Wrench *(see Figure 1-4)*.

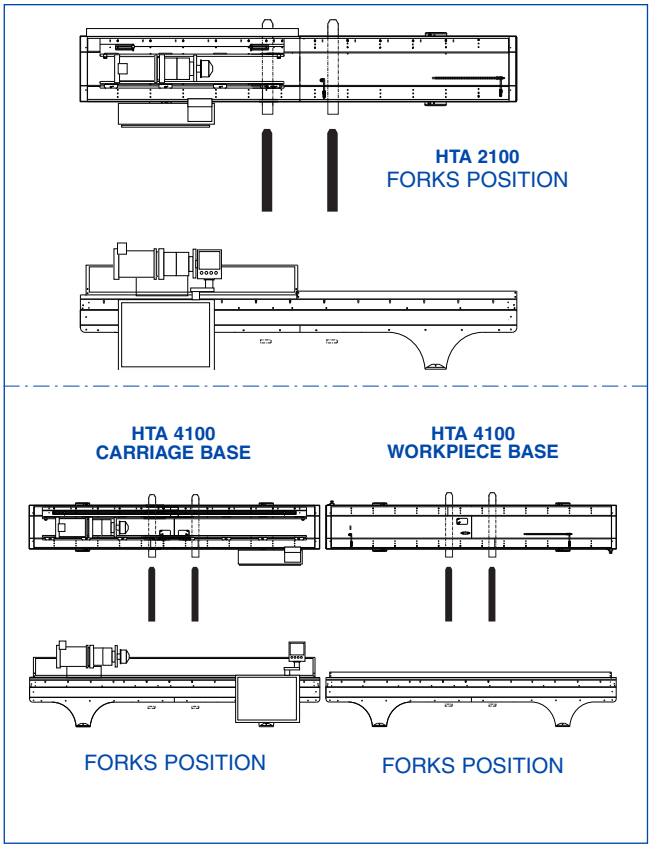


FIGURE 1-2, Lifting Machines

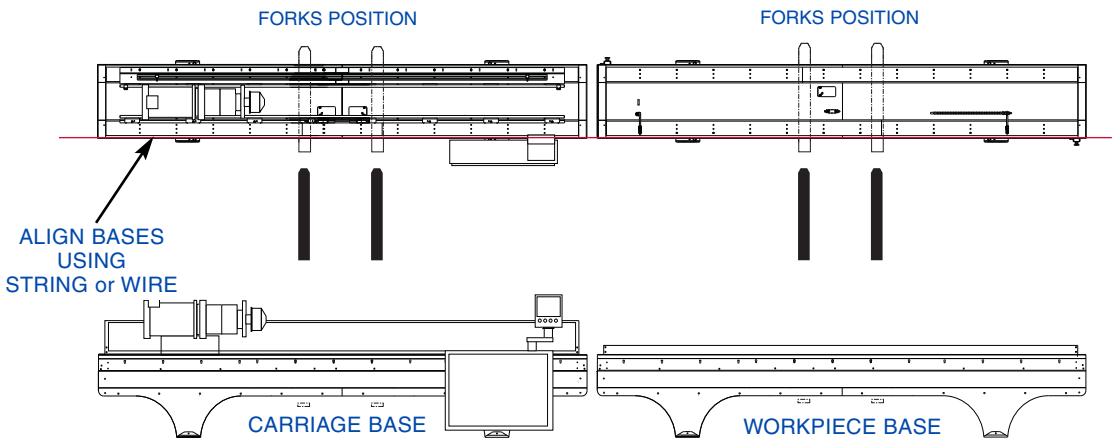


FIGURE 1-3, Connecting Tables (HTA4100)

f. Align holes in Workpiece Base with Carriage Base and install bolts securing two sections together.

NOTE: Use sealant on washer inner faces to prevent oil leakage.

g. Using a machinist level, level Workpiece Base by adjusting Leveling Setscrews in Support feet, using a 1-1/8 Open End Wrench *(refer to Figure 1-4)*.

h. Install Cover Plate as shown *(refer to Figure 1-5)*.

NOTE: If needed: Refer to I-HTA-555, Special Instructions for cover installation.

7. Inspect Machine and Components for dents, scratches, or damage resulting from improper handling by carrier. If damage is evident, immediately file a claim with carrier.

8. For permanent installation, secure Machines Support Feet to Floor with appropriate fasteners (not supplied).

9. *HTA-4100 ONLY*: The Workpiece Base has one E-Stop that must be connected to Carriage Base.

- E-Stop cable will be routed and connected later under Safety Arch Installation.

10. Remove all packing materials.

11. Remove bolt securing Operator Control Console and move Arm to operator position. Then install grub screw to limit arm movement *(see Figure 1-6)*.

- Route and connect electrical plug to Main Electrical Enclosure.

12. Remove packing material from two (2) Splash Guards on Machine *(see Figure 1-7)*.

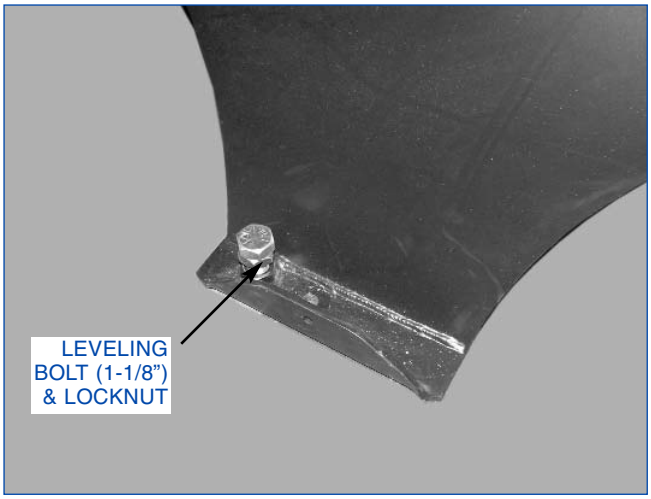


FIGURE 1-4, Leveling Screws

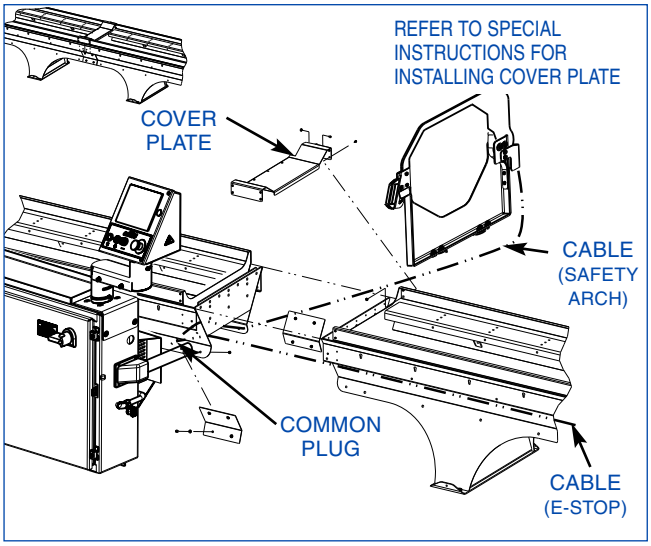


FIGURE 1-5, Cover Plate (HTA-4100 ONLY)

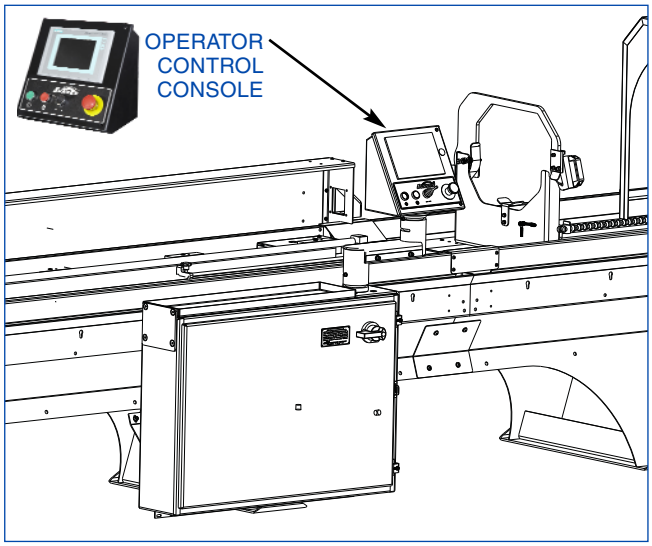


FIGURE 1-6, Operator Control Console

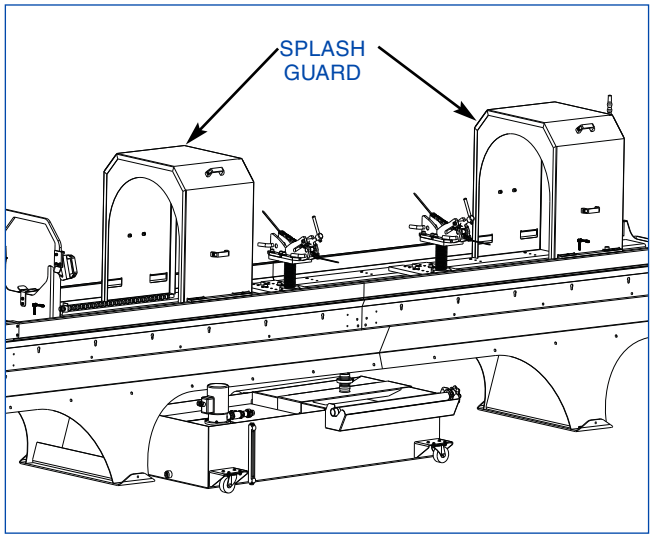


FIGURE 1-7, Splash Guard

13. Install coolant reservoir under machine and connect coolant hoses *(see Figure 1-8)*.

- Connect coolant intake and outlets supply lines to machines.
- Route and connect Pump Electrical Plug to Main Electrical Enclosure.

14. Check Coolant Nozzles *(see Figure 1-9)*.

15. Clean Spindle Carriage Ways with solvent to remove antirust and any foreign materials.

16. After cleaning Spindle Carriage Ways. Lightly lubricate with Mobil Way Oil 300 or equivalent.

ELECTRICAL REQUIREMENTS

All wiring is to be performed by a competent, Licensed Electrician in accordance with all local, state, and federal codes and regulations; along with any special information provided on machine nameplate or electrical specification plate.

WARNING

All wiring and electrical equipment service should be performed by authorized personnel ONLY.

CAUTION

Note model electrical supply requirement printed on machine nameplate or electrical specification plate. Do not attempt to connect machine if supply voltage is not following acceptable limits as noted on nameplate or electrical specification plate. If supply voltage is not within these limits MACHINE WILL BE DAMAGED.

Verify supply voltage is same as voltage on Machine Nameplate or Electrical Specifications Plate.

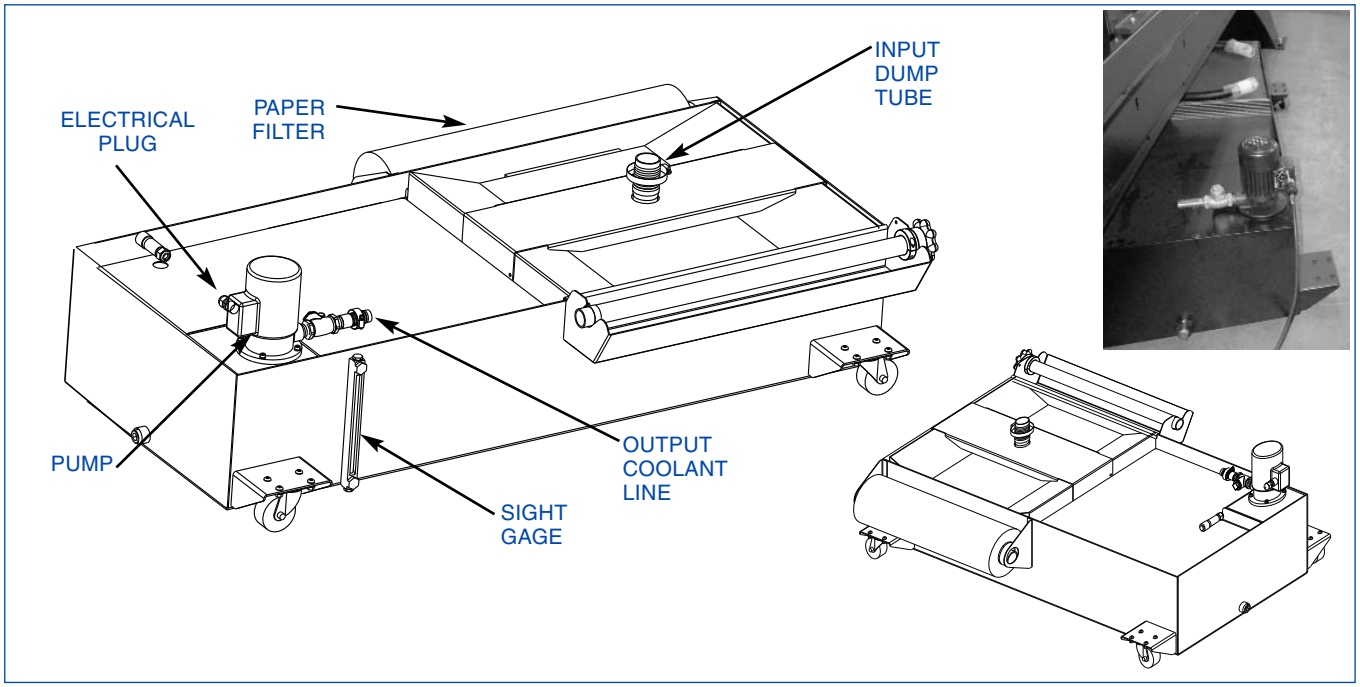


FIGURE 1-8, Coolant Reservoir

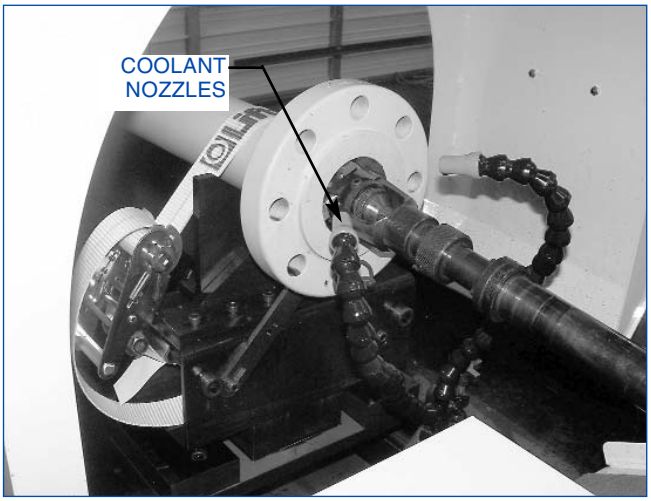


FIGURE 1-9, Coolant Nozzles

ELECTRICAL CONNECTION

Connect incoming Electrical Supply Cord (not supplied) to the Machine as follows *(see Figures 1-10 & 1-11)*.

NOTE: 380V machines require a H12-4 SJO or SO electrical supply cord; 460V machines require a 4FJ2-4SJO or SO electrical supply cord.

CAUTION

Doors should be closed and latched during operation to prevent accidental interruption of operation from doors being opened.

1. If applicable: Loosen Safety Latches on door(s) to enclosure, using a screwdriver and open Door.

WARNING

Residual Voltage exists for 2-3 minutes after Master ON/OFF Switch is turned OFF. Before working inside Enclosure, wait for all fans to stop running to allow drives to discharge.

2. The machine has been shipped without the master ON/OFF switch install. Locate master ON/OFF switch in base of electrical enclosure. Then, install Master ON/OFF Switch in Door and secure with two screws.

WARNING

You must use hole provided. Drilling any new holes in electrical enclosure may void machine warranty.

3. Route Electrical Supply Cord to Electrical Enclosure *(refer to Figure 1-10)*.

4. Remove hole plug from entrance hole in enclosure and install an approved oil tight fitting (not supplied).

5. Insert Electrical Supply Cord through Oil Tight Fitting and route to Electrical Disconnect Block. Allow for approximately 305 mm of cable from where it enters Enclosure; then cut off excess *(refer to Figure 1-11)*.

6. Strip 153 mm (6 in.) off cable's outer jacket.

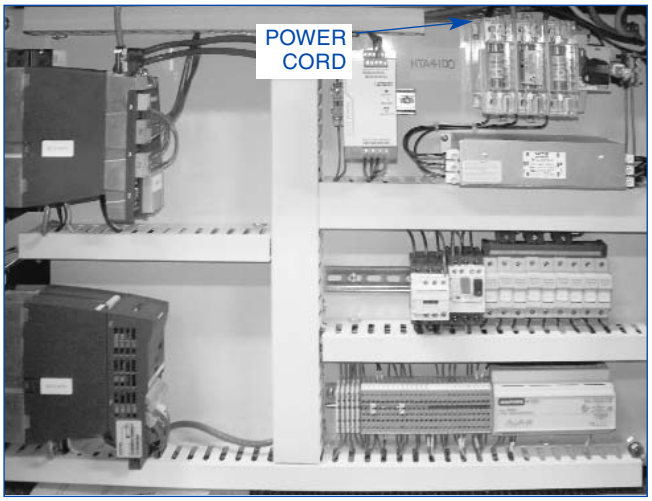


FIGURE 1-10, Route Cord

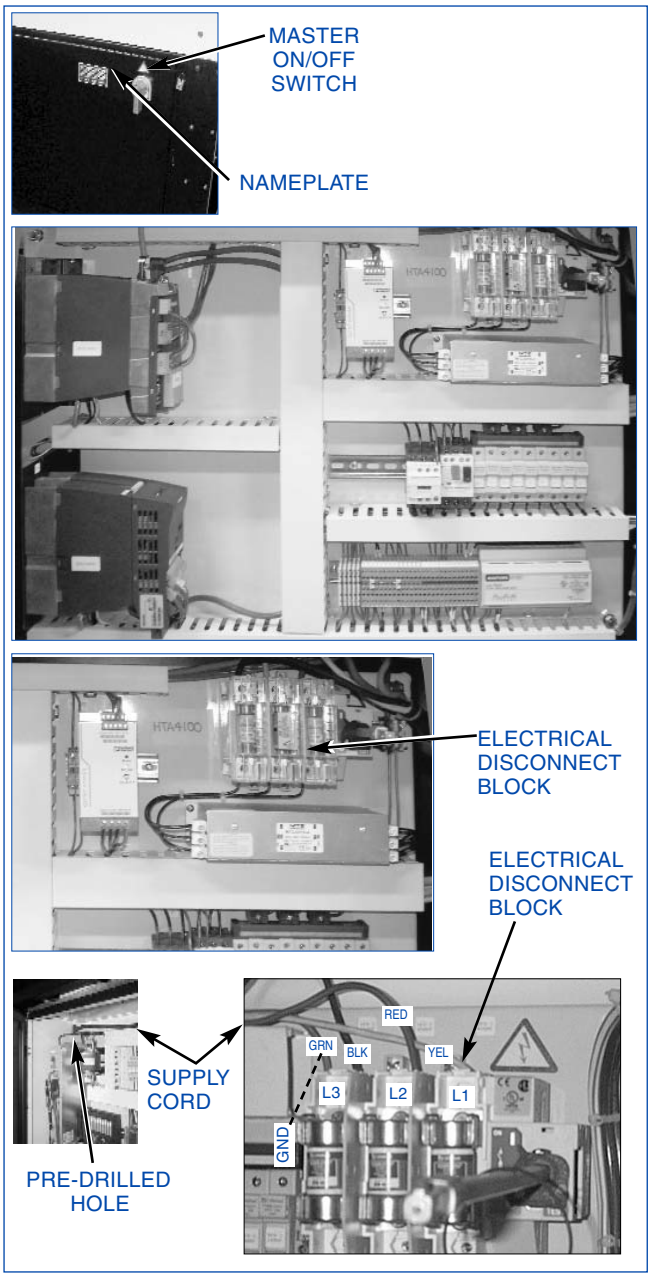


FIGURE 1-11, Electrical Enclosure

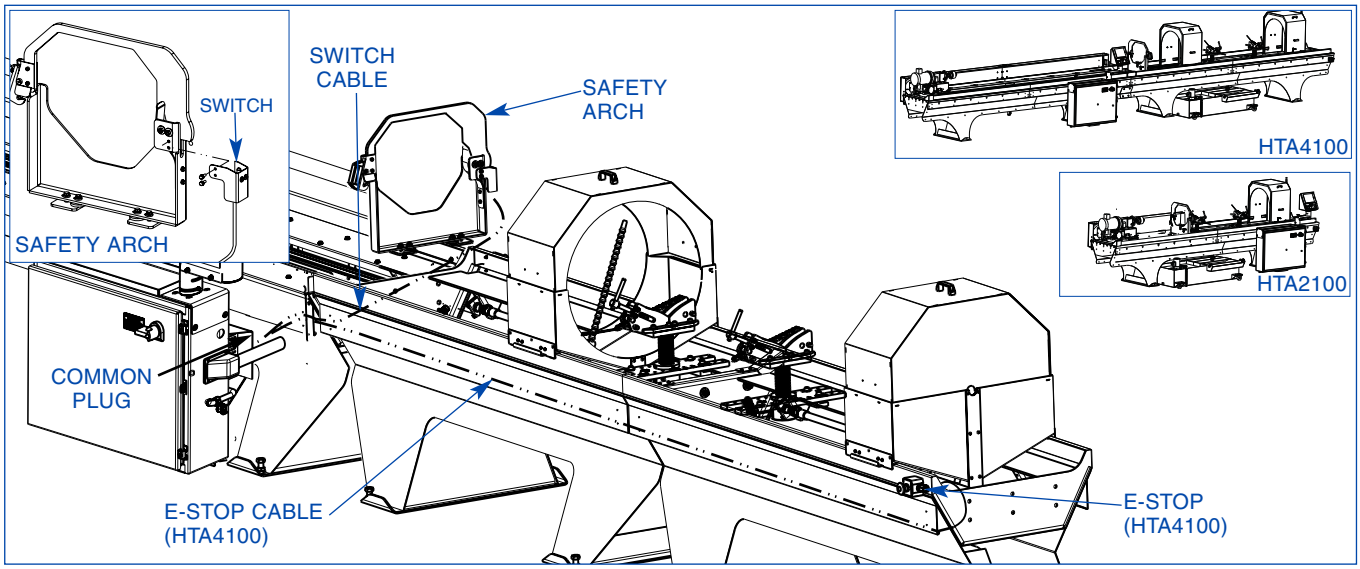
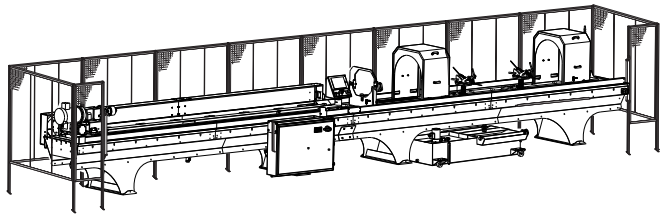


FIGURE 1-12, Safety Arch Switch



SENDER UNIT LIGHTS		
	Floating Blanking (Receiver)	Light indicates that one or more of the beams has been deactivated. This light should not be illuminated. If it is, contact a Sunnen representative for repair.
	Machine Run (Receiver)	Light indicates the protected machine is allowed to operate
	Machine Stop (Receiver)	Light indicates the protected machine is not allowed to operate
	Interlock (Receiver)	Light indicates the protected machine is not allowed to operate until the protected zone is cleared and the start button is pressed and released
	Status Indicator (Transmitter)	Indicates the light curtain is functional

FIGURE 1-13, Light Curtain

7. Strip 6 mm (1/4 in.) of insulation off each wire.

8. Connect Green Wire (GRN) to Ground Terminal beside Electrical Disconnect Block (Earth Ground).

9. Connect other three wires to Disconnect Block (CB1) as noted on Block (L1, L2, L3).

10. Route and secure Cord inside of Enclosure.

11. Tighten Oil Tight Fitting.

12. Close and secure/lock Door to Enclosure. . (Doors WILL NOT open unless Master ON/OFF Switch is in OFF position.)

13. Route and connect Electrical Supply Cord to power source. (PLUG Machine's Electrical Supply Cord into a properly polarized grounding-type wall receptacle.)

14. Turn ON Master ON/OFF Switch. (Doors WILL NOT open unless Master ON/OFF Switch is in OFF position.)

SAFETY ARCH

Machine comes with a Safety Arch Assembly attached to the Workpiece Base. The Safety Arch Assembly has a Switch that detects when the arch is opened. This Switch is prewired to be connected to the Main Electrical Enclosure and is assembled on Safety Arch. Install Arch as follows *(see Figure 1-12)*.

1. Remove packing materials.

2. Route Safety Arch Switch Cable behind and under machine.

- Attach Safety Arch Switch Cable *(and E-Stop Cable -HTA-4100 only)* along lower front section of carriage base with provided cable ties.
- Then connect to Main Electrical Enclosure.

NOTE: The operational position of the switch with its bracket is preset at the factory but should be checked after installation. The switch should activate any time the arch is opened.

● If switch activation point needs to be reset, reposition switch up or down using vertical slots in switch bracket. Take care that switch is not set too high causing roller plunger on switch to not have any travel left when safety arch is opened.

3. With machine at rest. Verify that machine will not start when safety arch is opened.

4. Verify that braking system is working properly. Machine must come to a quick controlled stop when safety arch is opened. Drive faults, spindle coasting and stroker coasting are unacceptable.

OPTIONAL LIGHT CURTAIN

(CE Machines Only) CE machines come with optional Light Curtain and guarding installed. Light Curtain alignment must be tested for proper function after machine installation. To check, proceed as follows *(see Figure 1-13)*:

1. Set Light Curtain to a height of 855mm as shown *(see Figure 1-14)*.
● Check for signs of external damage to the light curtain transmitter, receiver, or cables and wiring.

2. Connect Light Curtain Cables to Light Curtain Receiver and Transmitter as shown *(see Figure 1-15)*.
● Inspect electrical connections between guarded machine's control system and light curtain. Verify they are properly connected.

3. Turn on power to machine.

4. Verify that curtain is in alignment. The individual beam indicators located on receiver will illuminate when alignment of a beam is not met *(refer to Figure 1-13)*.

LIGHT CURTAIN FUNCTION TEST

(CE Machines Only) Check Light Curtain operation as follows*(see Figure 1-16)*:

WARNING

The test outlined below must be performed at installation, according to employer's regular inspection program and after any maintenance, tooling change, setup, adjustment, or modification to Light Curtain System or the guarded machine. Where a guarded machine is used by multiple operators or shifts, it is suggested that the test be performed at each shift or operation change. Testing ensures that Light Curtain and machine control system work properly to stop the machine. Failure to test properly could result in injury to personnel.

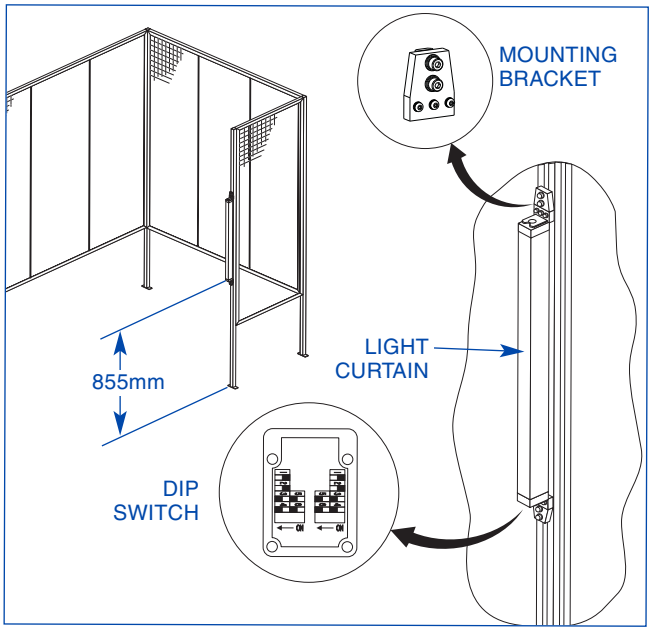


FIGURE 1-14, Light Curtain Height

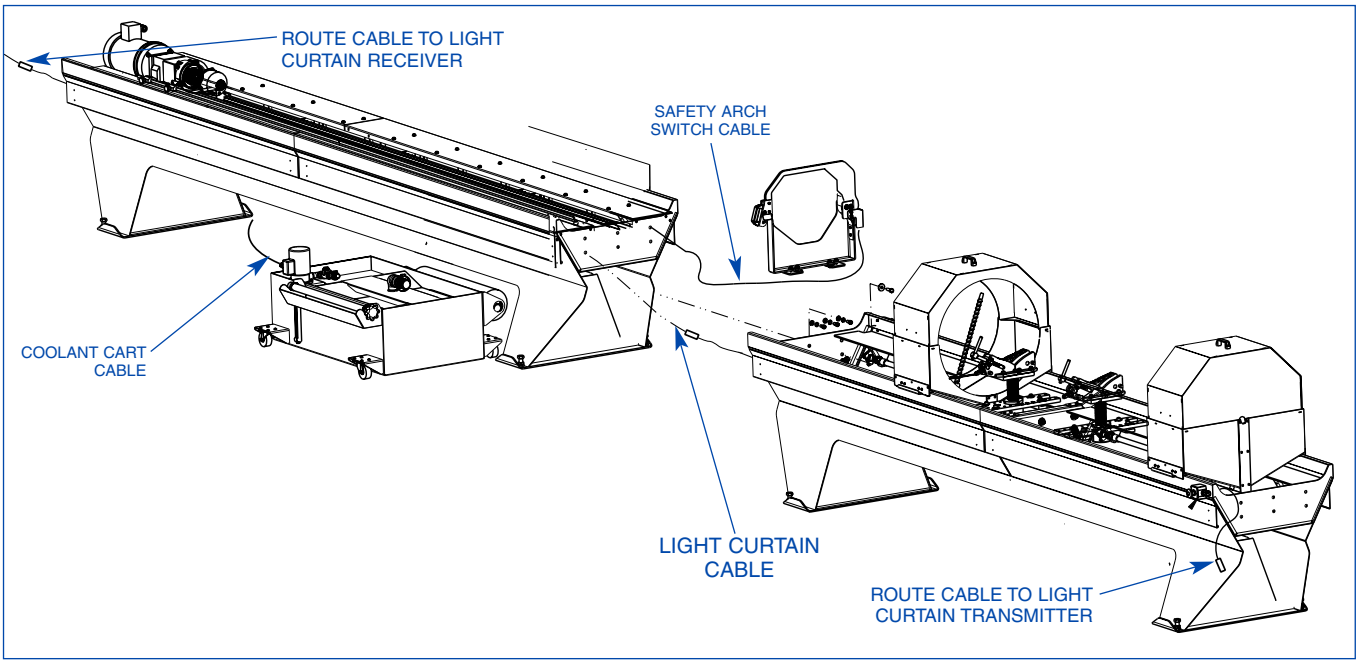

ROUTE CABLE TO LIGHT CURTAIN RECEIVER
SAFETY ARCH SWITCH CABLE
COOLANT CART CABLE
LIGHT CURTAIN CABLE
ROUTE CABLE TO LIGHT CURTAIN TRANSMITTER

FIGURE 1-15, Light Curtain Cable Connections (CE Machines ONLY)

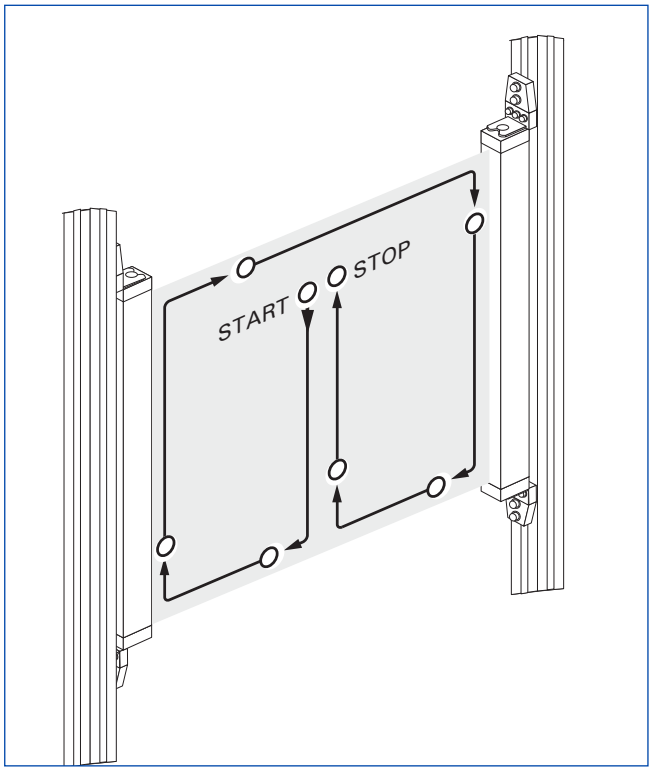


FIGURE 1-16, Light Curtain

WARNING

When light curtain key switch is deactivated a cycle cannot begin, however, if machine is in middle of a cycle and switch is flipped, machine will finish its stroke in that cycle and then come to a complete stop.

1. Interrupt light curtain system with proper size test object (Test object size: 30 mm diameter). When using the test object, guide it through the detection zone as shown below. At least one individual beam indicator must be lit while test object is anywhere in detection zone.

2. Start machine. While machine is in motion, interrupt detection zone with test object. Machine should stop immediately. Never insert test object into dangerous parts of machine.

3. With machine at rest, interrupt detection zone with test object. Verify that machine will not start with test object in detection zone.

4. Verify that braking system is working properly. Machine must come to a quick controlled stop when light curtain is interrupted. Drive faults, spindle coasting and stroker coasting are unacceptable.

OPERATIONAL CHECK

Read IOM Instructions, Sections 1 and 2 thoroughly and carefully before performing Operational Check.

1. Operate Machine and check rotation of Coolant Pump. Rotation is indicated on pump fan cover. If rotation is incorrect, reverse any two wires (red, white, or black) of electrical supply cord, where they connect to Disconnect Block.

2. Set up and test all machine functions *(refer to Section 3, Setup & Operation)*.

3. After unpacking and installing Machine, clean and lubricate *(refer to Section: 4, Routine Maintenance)*.

NOTES

SECTION 2
PREPARING FOR OPERATION

GENERAL
Consult this section when preparing Machine for operation.

MAJOR COMPONENTS
For location of major components on machine *(see Figure 2-1)*.

OPERATOR CONTROLS
For location and function of Operator Controls *(see Figure 2-2 & Table 2-1)*.

SAFETY SYMBOLS
For a description of safety symbols that may be used on this machine refer to Table 2-2.

HONING TOOL
Assembly and install Honing Tool per instructions packaged with Tooling.

1. Assemble Honing Tool *(see Figure 2-3)*.

NOTE: The HTA is designed to use both ANR and MPS driveshaft extensions. ANR shafts are designed to bolt together and MPS shafts are designed to screw together. Thus, when using ANR Tooling on a MPS Driveshafts, a MPS2220A Output Adapter must be used *(refer to Figure 2-3)*

2. Guide Honing Tool into the bore.

3. Align Input Yoke Adapter on Honing Tool with Drive Ring, and guide adapter onto Hex Shaft *(see Figure 2-4)*.

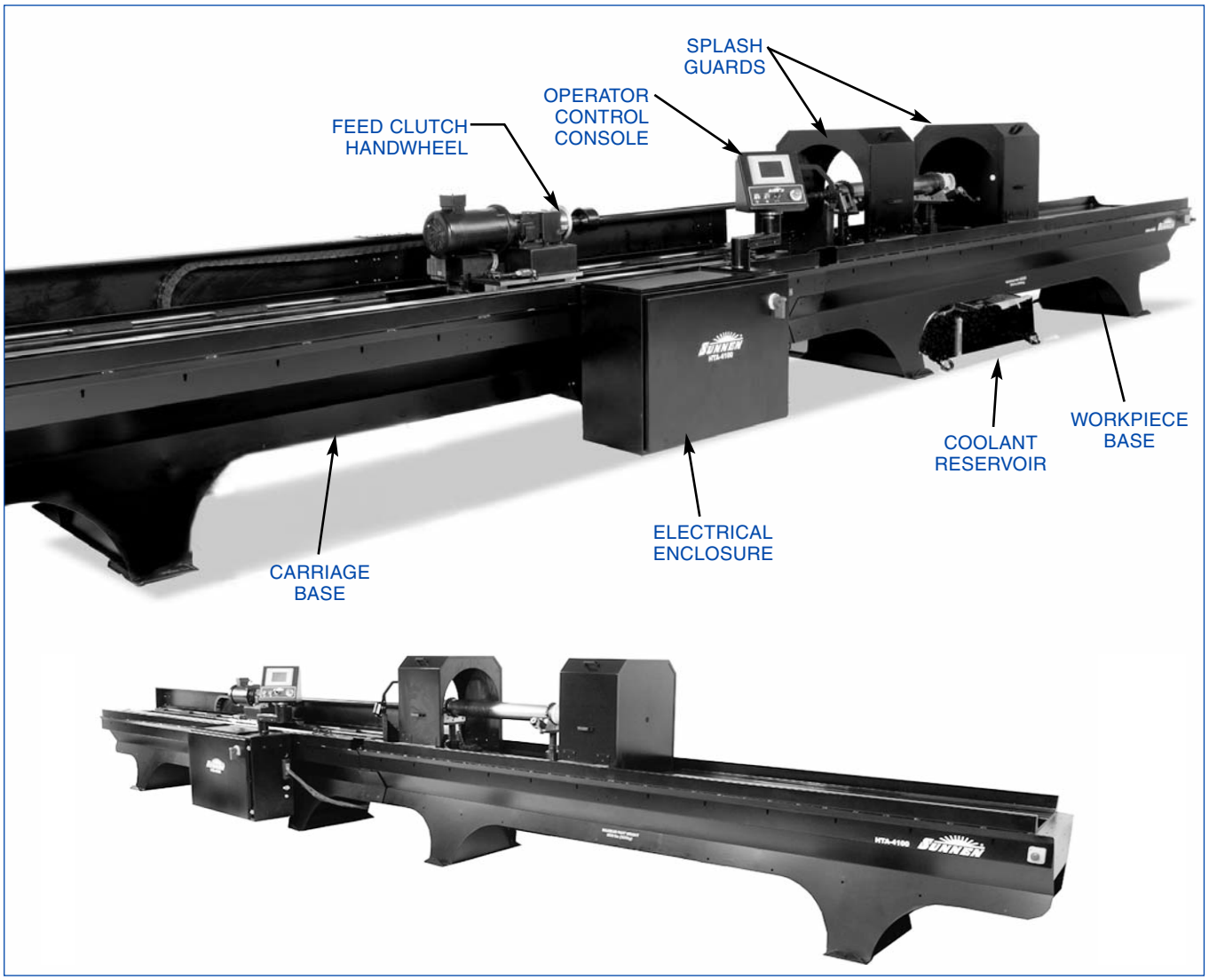


FIGURE 2-1, Major Components

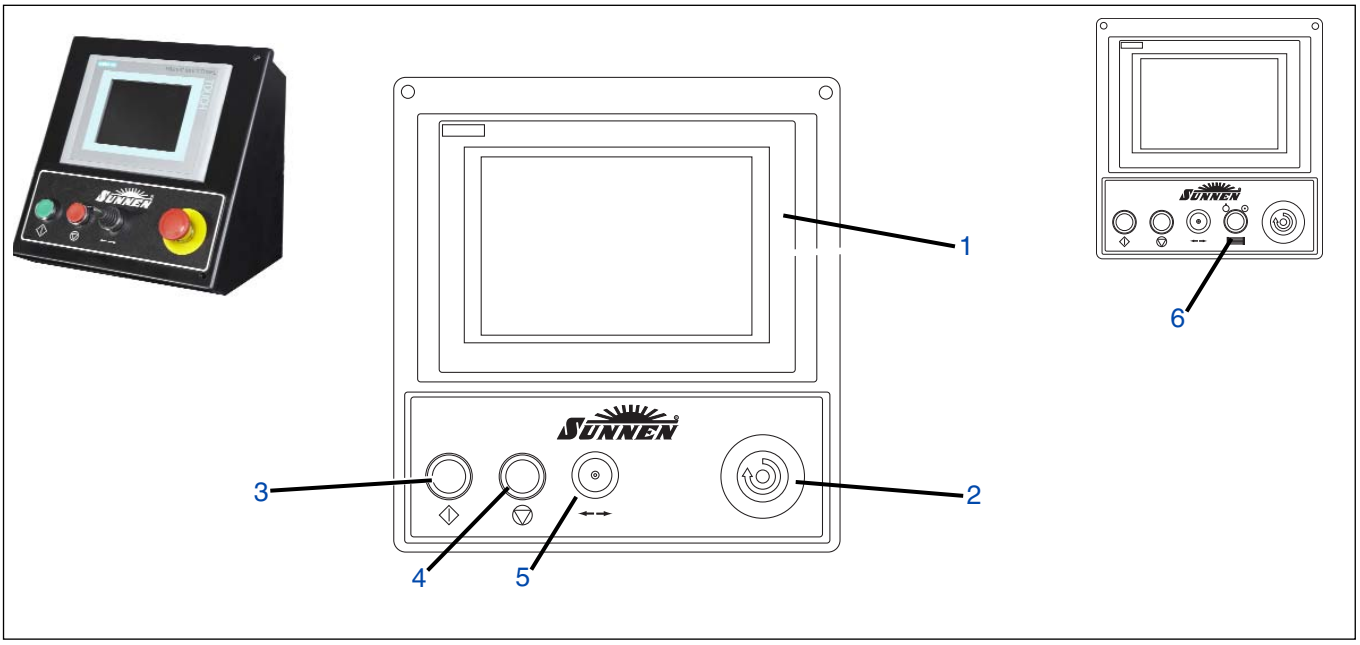


FIGURE 2-2, Operator Control Panel

TABLE 2-1, Operator Control Panel

1	LCD Display and Touch-Screen Operator Panel.	Operation of the machine can generally be done via the touch screen, which means that a function may be started by touching the corresponding key on the screen
2	SAFETY / EMERGENCY STOP	Stop the machine in a emergency situation
3 ◇	Hardware Cycle START Button	Start the honing cycle if the machine is in AUTO
4 △	Hardware Cycle STOP Button	Stop the honing cycle.
5 ←→	Joystick for manual Stroke movement	Manual movement of the carriage for setup and to over ride the AUTO mode operating direction. (left / right)
6	Light Curtain (Key Switch)	(CE Models ONLY) Key Activated Light Curtain. Machine will automatically Stop when light beam is interrupted.

TABLE 2-3, Safety Symbols

SYMBOL	DESCRIPTION	FUNCTION
	Warning Label	Warns that an electrical hazard exists.
	Warning Label	Warns that safety glasses should be worn at all times when operating this machine.
	Warning Strip	Warns that a *physical hazard exists*, and that proper precautions should be taken.
CE	Label	Designates this machine is *"CE" compliance*.
	Warning Label	Warns that a *hazard from objects falling off work table* exists and that proper precautions should be taken.
	Warning Label	Warns not to hold workpiece in hand without a torque resisting fixture.
	Warning Label	Warns that an arc flash hazard exists.

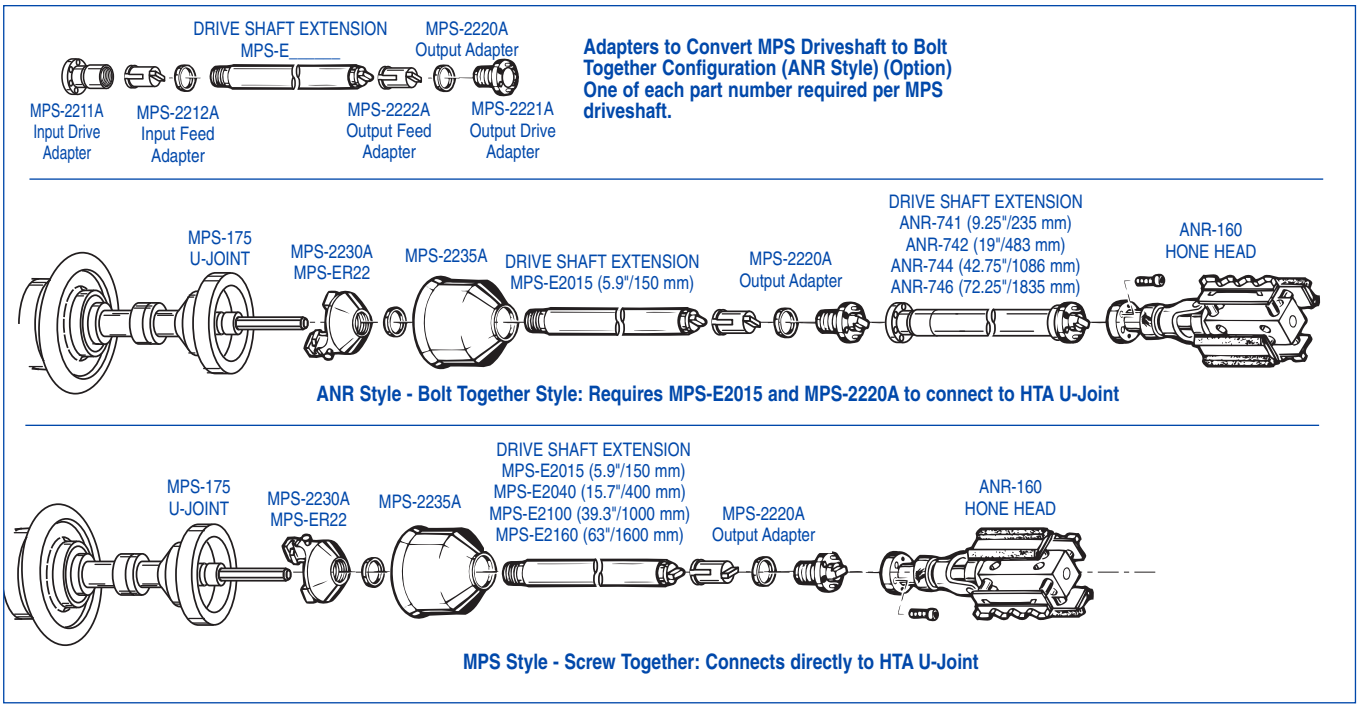


FIGURE 2-3, HTA Drive Shaft Comparison for use with ANR-Style Hone

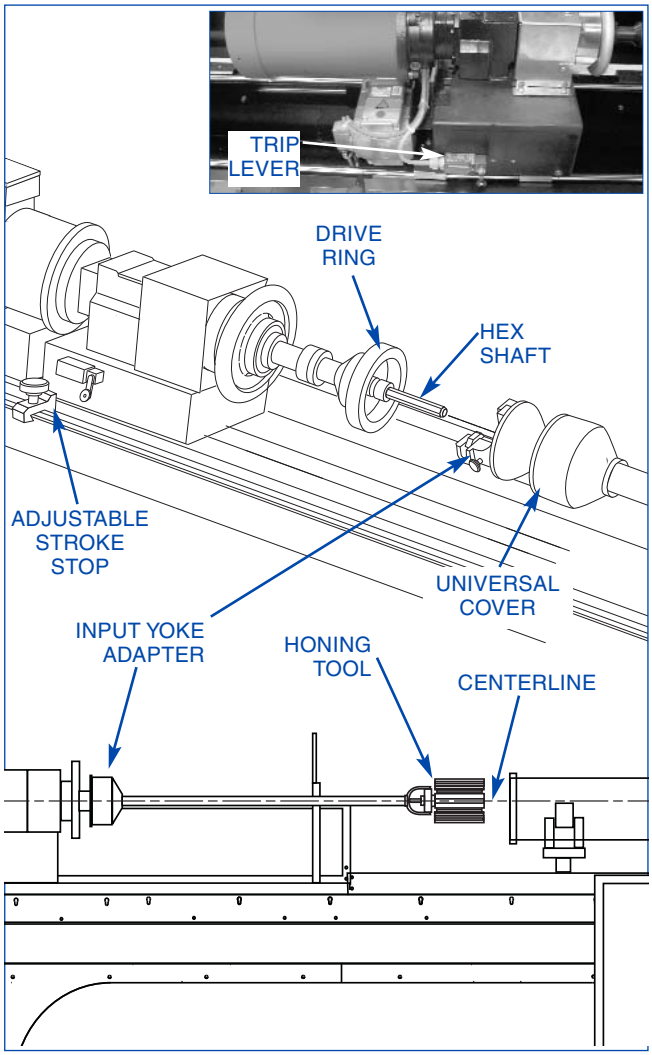


FIGURE 2-4, Input Yoke Adapter

4. Rotate input Yoke Adapter (clockwise) to engage and Lock into the Drive Ring on the Spindle Nose.

5. Slide Rubber Boot over Input Yoke Adapter *(refer to Figure 2-4)*.

WORKHOLDING FIXTURE

Position the Workholding Fixture as follows *(see Figure 2-5)*:

1. Turn OFF all electrical power.

2. Loosen four Socket Head Capscrews in base of Workholding Fixtures *(see Figure 2-6)*.

3. Position Fixture so Workpiece will be clamped close to its Ends (approx. 300-500mm). Configure Fixture height so centerline of Workpiece aligns with centerline of Spindle *(refer to Figure 2-5)*.

4. Lift Workpiece into Machine, using a hoist as required.

5. Place tool inside Workpiece bore and snug tool with Handwheel.

6. Place a level on driveshaft and raise or lower Screw Assembly on Workholding Fixture until driveshaft is level.

The centerline of the Workpiece should be in line with the centerline of the spindle.

7. Wrap Chains around Workpiece and through Wedge Clamps. Secure by inserting Locking Pins and Clevis Pins *(refer to Figure 2-6)*.

8. Adjust tension on Chains using Clamp Handle. Hand tighten to approximately 40-50 N/m (2.8-3.5 lbs/ft).

CAUTION

Use care when tightening chains - Over tightening may distort workpiece.

9. Tighten four Capscrews in base of each Workholding Fixture *(refer to Figure 2-6)*.

10. Tighten Clamp Collar Screw on Fixture Base.

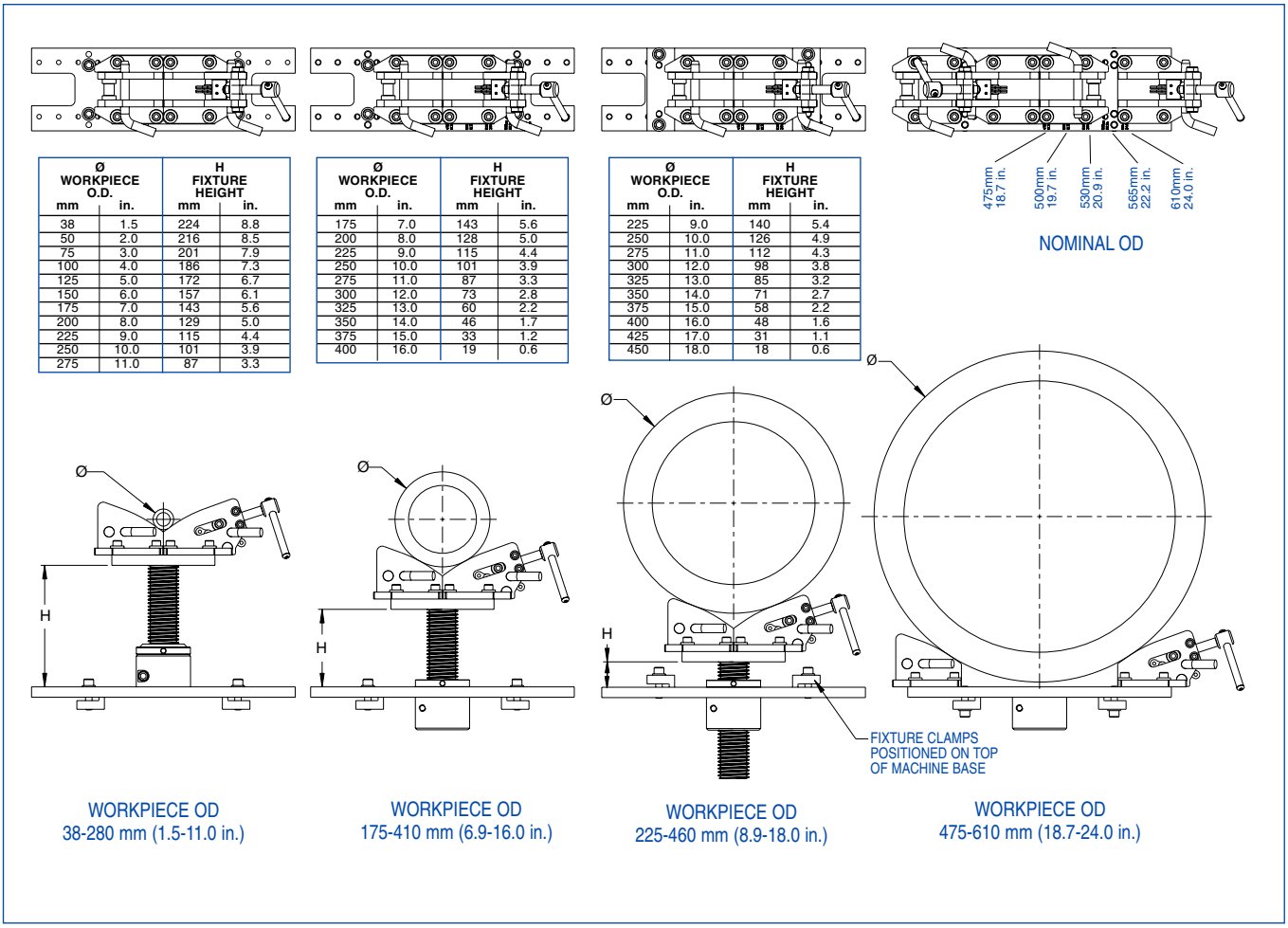


FIGURE 2-5, Fixture

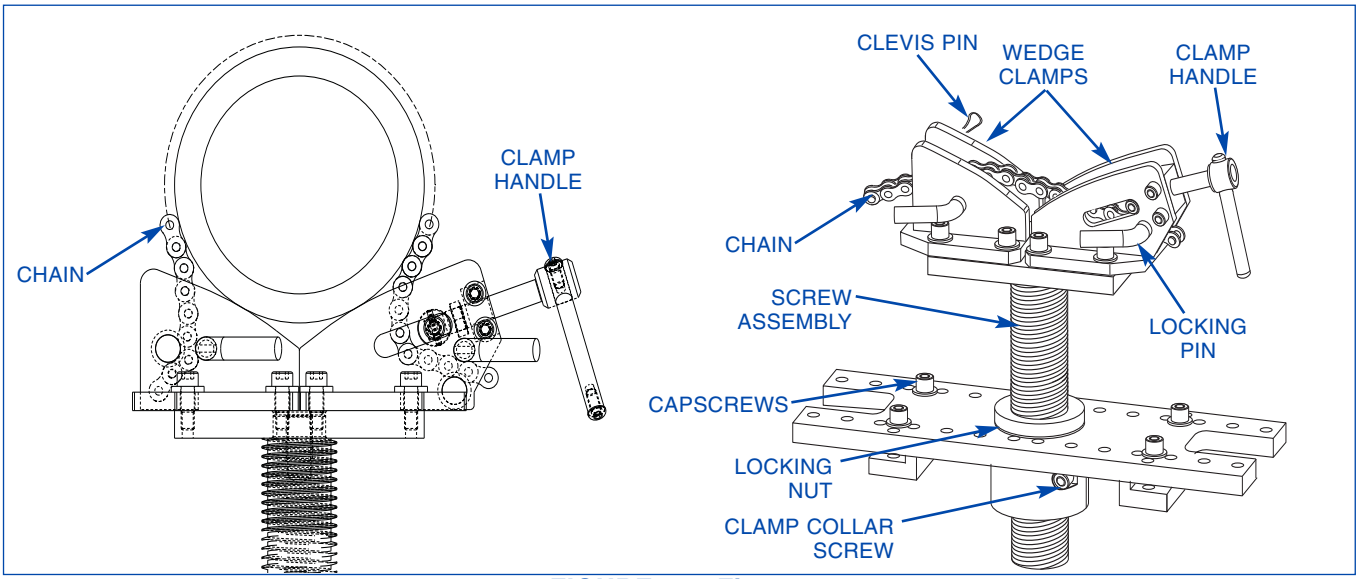


FIGURE 2-6, Fixture

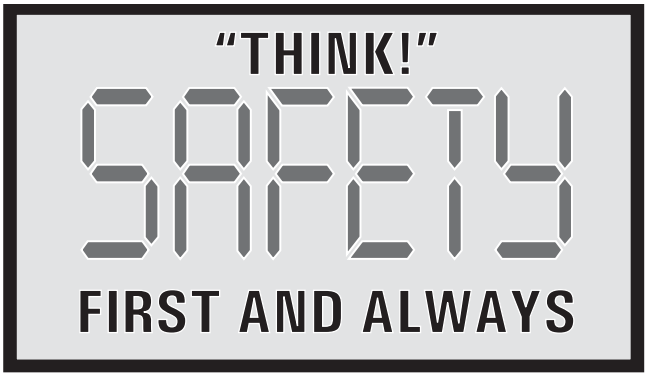
SECTION 3
SETUP & OPERATION

GENERAL

This section describes a step-by-step operating procedure for the Machine. Prior to starting the Machine, Operator shall ensure:

• All prerequisites described in sections 1 and 2 are complete.

• All personnel are clear of machine.



SAFETY PRECAUTIONS

The following precautions should be followed to ensure maximum safety of personnel while working on or around Machine.

WARNING

Most accidents occur through failure to observe basic safety rules and/or operating procedures. Accident can be avoided by being alert and recognizing potentially hazardous situations before an accident occurs. Individuals performing operation, maintenance, and/or repair should have the necessary training, skills, and tools required to perform the functions properly and safely. The safety information provided in this manual serves as a basic guide in an attempt to prevent injury or death.

Sunnen cannot anticipate every possible circumstance that might involve a potential safety hazards. Therefore, the safety warnings and precautions presented in this manual and other instructions packaged with this equipment can not be all inclusive. If a tool, procedure, work method, or operating technique that is not specifically mentioned by Sunnen is used, you must satisfy yourself that it is safe for you and for others. Make sure the product or machine will not be damaged or be made unsafe by any operation, lubrication, maintenance, or repair procedures that you choose.

If any doubt arises about the correct, safe method of performing any steps of these procedures, DO NOT proceed. Seek out expert assistance from a qualified person.

General

WARNING

To avoid personal injury or death, carefully read and understand all instructions before attempting to operate any equipment. DO NOT operate or work on a machine unless you read and understand the instructions and warnings in this and all other applicable manuals. Go online to www.sunnen.com or contact Sunnen for replacement manuals. Proper care is your responsibility. Always follow all State and Federal health and safety laws and/or local regulations.

Keep all visitors a safe distance from work area.

DO NOT use in dangerous environment. DO NOT use machines in damp or wet locations, or expose them to rain. Keep work area well lighted.

Keep fingers away from any moving parts or pinch points to prevent pinching and crushing.

Wear proper safety items such as, safety glasses, gloves, non-slip safety shoes and other personal safety equipment as necessary or required.

Installation & Maintenance

WARNING

To prevent personal injury or death, always disconnect the main electrical power source before opening the electrical control box.

Contact with electrical components may cause injury or death. Completely disconnect the main power, remove all jewelry, and use properly insulated tools when working on this equipment.

Work Area

WARNING

Personal injuries can occur as a result of using pressurized air. Maximum air pressure at the nozzle must be below 205 kPa (30

psi) for cleaning purposes. Wear protective clothing, protective glasses, and a protective face shield when using pressure air.

Clean up all leaked or spilled oil immediately. Oil leaked or spilled onto any hot surfaces or electrical components can cause a fire, resulting in personal injury or death.

DO NOT operate machine while lifting devices are installed.

Ensure workpiece is securely fixtured and located before operating.

Ensure all guards are in place before operating.

Ensure area is clear of other personnel before operating machine.

When lifting part or tooling use proper lifting procedures. DO NOT overreach; keep proper footing and balance at all times.

Remove keys and wrenches from machine before honing.

Personal injury can result from slips or falls. DO NOT leave tools or components laying around the work area and clean up all spilled fluids immediately.

Operation

WARNING

DO NOT wear loose clothing, jewelry, watches, gloves or anything else that might catch on any part of the machine.

CE Push E-STOP Button and turn OFF electrical power at Disconnect Switch, on Electrical Enclosure when preforming service not requiring power.

CE Turn OFF electrical power at Main Power Source when preforming maintenance on, or cleaning of Electrical Control Enclosure.

An Arc Flash Hazard Exists. Follow safe work practices and wear appropriate Personal Protective Equipment. Follow proper lockout/tagout procedures. *Failure to comply can result in death or injury.*

CE When light curtain key switch is deactivated a cycle cannot begin, however, if machine is in middle of a cycle and switch is flipped, machine will finish its stroke in that cycle and then come to a complete stop.

Clear area of excessive lubricant or lubricant spills.

DO NOT adjust stroke length while Spindle Retractor Carriage is not in locked position.

KEEP hands clear of all moving parts. Stay clear of all moving parts.

To avoid personal injury, allow spindle and stroking arm to come to a complete stop before removing part.

OPERATING HINTS

There are several features on the HTA Machines for correcting problems in the bore. These features are as follows:

1. During honing cycle, the Joystick can be used at any time to reduce “Tight Spots”. Moving the Joystick in the opposite direction of the stroke will cause the stroke to instantly change direction.

2. Additionally, the Joystick can be used to stop or oscillate the stroke at either end of the bore, for correcting barrel or bellmouth conditions. By holding the Joystick at the end of the stroke it will short stroke until you let go of the Joystick.

3. The Dwell Button provides the ability to dwell at any location in the bore, by holding the button while in a tight spot in the bore.

SETUP & OPERATION

Start-up instructions for all HTA-Series Machines.

1. Install Workpiece *(refer to Section 2)*.

2. Turn ON power at Main Power Disconnect Switch, on Electrical Enclosure.

3. Release all Emergency STOP Buttons.

4. When instructed to Home Machine, press HOME MACHINE button, and wait to complete.

NOTE: During homing the tool and driveshaft must be disconnected from the carriage.

5. Press SETUP, enter part specifications and then press Calculate Defaults button. The software automatically calculates values as shown in tables on the next page.

6. Press SETUP again and verify:
   - Spindle Speed
   - Stroke Speed
   - Spindle/Stroker Load (Selected on DISPLAY SETTINGS Screen)

7. Enter desired Honing Time.

8. Assemble and install Honing Tool *(refer to Section 2)*.

9. If not connected: Use JOYSTICK to move carriage so Honing Tool can be connected.

10. Make sure the stones are loose and then use JOYSTICK to move Honing Tool to end of Workpiece, then run Tool approximately 1/3 of Stone length out of Workpiece to allow for overstroke.

11. Press Teach End Of Stroke button.

12. Set Right Adjustable Stroke Stop at 3 mm (1/8 in.) to right of Limit Switch Arm *(see Figure 3-1)*.

13. Use JOYSTICK to move Honing Tool to start of Workpiece, then run Tool approximately 1/3 of Stone length out of Workpiece to allow for overstroke.

14. Press Teach Start Of Stroke button.

15. Set Left Adjustable Stroke Stop 3 mm (1/8 in.) to left of Limit Switch Arm.

TABLE 3-1, Feed Rate

DIAMETER mm	DIAMETER in.	SPINDLE SPEED RPM	FEED SETTING % ROUGH[1]	FEED SETTING % FINISH[2]
50	2	350	10%	30%
75	3	230	10%	40%
100	4	175	20%	50%
125	5	140	20%	60%
200	8	88	20%	70%
305	12	58	20%	75%
380	15	46	20%	75%

FOR FASTER STOCK REMOVAL INCREASE FEED.

IF STONES WEAR RAPIDLY:
- Reduce Feed Rate
- Use Harder Stones

[1] Always use this setting during the first few (roughing) strokes.

[2] For finishing use Feed Setting of 15% to 20%.

TABLE 3-2, Spindle Speed (Standard)

SPINDLE-SPEED IN RPM					
ø in mm	RPM	ø in mm	RPM	ø in mm	RPM
under 40	430	155	113	360	48
45	388	160	110	380	46
50	350	165	106	400	44
55	318	170	103	425	41
60	292	175	100	450	39
65	270	180	97	475	37
70	250	185	95	500	35
75	233	190	92	525	33
80	219	195	90	550	31
85	206	200	88	575	30
90	195	210	84	600	29
100	175	220	80	625	28
105	167	230	76	650	27
110	160	240	73	675	26
115	152	250	70	700	25
120	146	260	67	725	24
125	140	270	65	750	23
130	135	280	63	800	22
135	130	290	60	850	21
140	125	300	58	900	20
145	121	320	55	950	18,5
150	117	340	51	1000	17,5

The optimum cutting Speed is about 55m/min.

Calculate Optimum Spindle Speed = $\frac{17500}{\text{Bore Diameter (in millimeters)}}$ = RPM

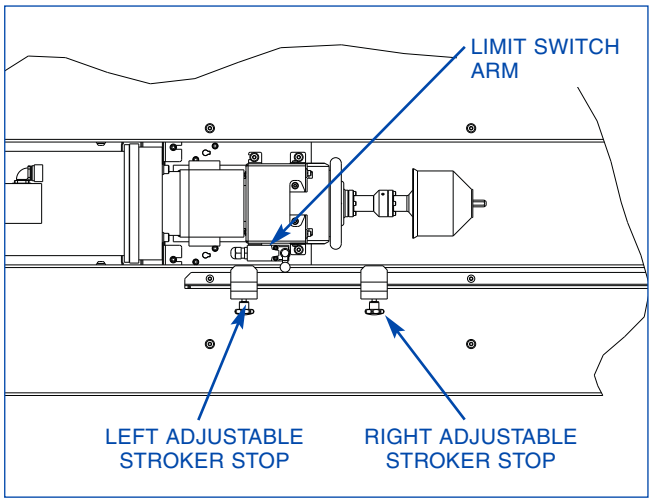


FIGURE 3-1, Stroker Stops

16. Rotate Handwheel until all the stones contact the bore wall. Shaking the Honing Tool keeps the hone from binding in the bore while the stones are being fed out.

17. Press RUN button on HMI.

18. Position Coolant Nozzle to direct oil into the bore. Ensure there is enough clearance for overstroking by the Honing Tool. Use ONLY one Coolant Nozzle, so metal chips may be properly flushed from the part, during honing.

19. Press COOLANT OFF button and open the Flow Control Valve on the Coolant Nozzle to check coolant flow. Then press COOLANT ON.

20. Install and position Splash Guards.

21. Set the COOLANT and FEED to AUTO if desired, otherwise manual operation can be used.

22. Set Feed Clutch value as desired. The setting should be high enough that the clutch cycles on and off and is not constantly on *(see Tables 3-1 & 3-2)*.

IMPORTANT

If the clutch is constantly feeding it will become hot and reduce the life of the clutch.

23. Set STROKER to AUTO mode.

24. Press Cycle START Button to initiate a Honing Cycle.
When feed is in AUTO mode honing Tool will continue to feed stones out, to maintain spindle load, until Honing Cycle Time reaches zero (0) at which time the Honing Cycle ends.
Pressing Cycle Stop Button will stop the cycle when the stroker reaches the left end of the stroke.

NOTE: Pressing Red E-STOP Button will Shut OFF power to all machine functions. After E-STOP Button has been pressed: E-STOP Button must be released, Cycle START Button must be pressed before machine will operate. When honing cycle is interrupted Timer will be reset when cycle is restarted.

25. Periodically, check the coolant level on top of the filter paper in the coolant reservoir. If the filter paper is dirty and coolant is overflowing the paper, then pull fresh paper across the drain screen and/or reduce coolant flow to the workpiece.

CAUTION

Failure to advance the paper when it becomes dirty can cause the coolant to backup and overflow reservoir.

26. Retract stones slightly by turning Handwheel.

27. Slide Honing Tool out of Bore.

NOTES

WARNING

An Arc Flash Hazard Exists. Follow safe work practices and wear appropriate Personal Protective Equipment. Follow proper lockout/tagout procedures. *Failure to comply can result in death or injury.*

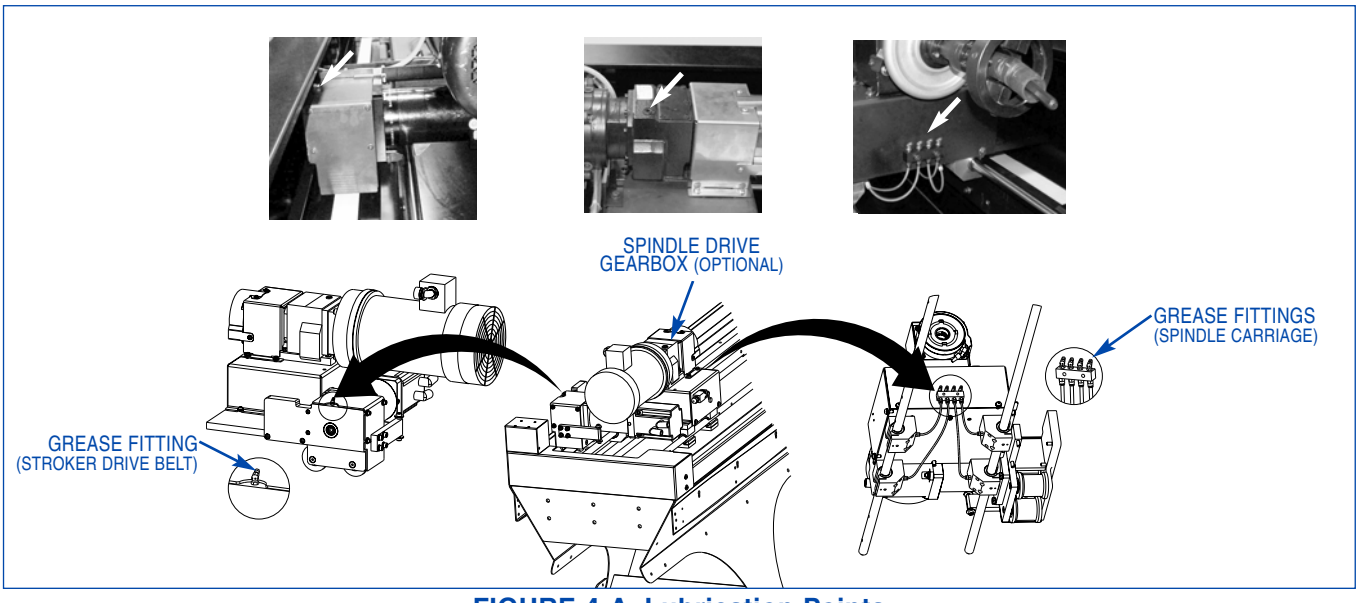


FIGURE 4-A, Lubrication Points

SECTION 4
ROUTINE MAINTENANCE

GENERAL

The following procedures and suggested maintenance periods are given as guides only and are not to be construed as absolute or invariable. Local conditions must always be considered. Each machine must be maintained individually according to its particular requirements.

WARNING

Turn OFF electrical power when performing service on your machine, which does not require power. Disconnect Machine from main power supply before any work is performed inside of Electrical Enclosure.

An Arc Flash Hazard Exists. Follow safe work practices and wear appropriate Personal Protective Equipment. Follow proper lockout / tagout procedures. *Failure to comply can result in death or injury.*

CLEANING

Daily: Wipe exterior of Machine with a clean dry cloth to remove any coolant, dust and grim. Empty Filter Paper Tray as required.

Monthly: Wipe exterior of Machine with a clean dry cloth. Then clean the exterior of Machine with warm water and a mild detergent or mild industrial solvent. Rinse thoroughly with clean hot water and wipe dry. Lightly lubricate following lubrication instructions.

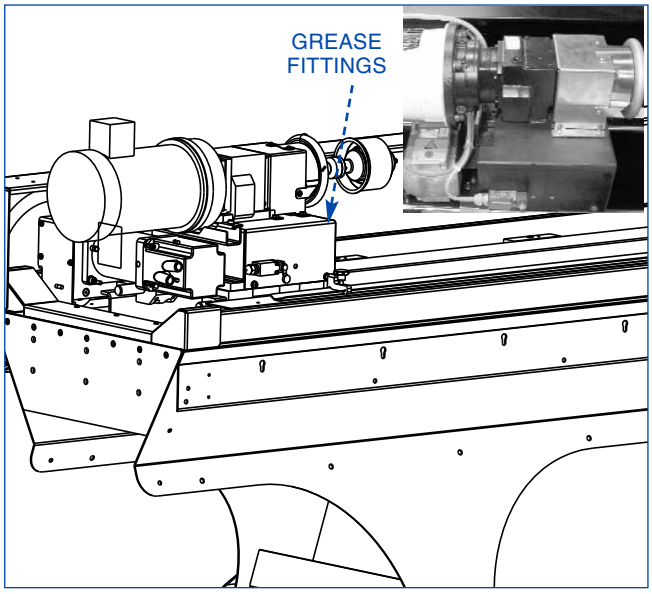


FIGURE 4-1, Spindle Carriage Ways

LUBRICATION

NOTE: The intervals between lubrication will vary with amount of use your Machine receives. Lubricate all components at least once every three (3) months.

CAUTION

Be careful not to get oil/grease on drive belts or feed clutch brake.

1. SPINDLE CARRIAGE WAYS: Spindle Carriage Ways Linear Bushings are equipped with a grease fitting block. Daily apply 1 pump of Mobilith AW-1 to each fitting *(see Figures 4-A & 4-1)*.

Set up machine to stroke the full length of the machine stroke at 5 fpm for 10 minutes.

2. SPINDLE DRIVE GEARBOX (Optional): Change ISO 220 EP mineral oil every 10000 hrs or 3 years whichever comes first.

NOTE: Every 20000 hrs or 6 years if a synthetic lubricant is used. Oil should be changed more frequently if used in hostile environment.

Siphon out old oil; then fill with fresh ISO 220 EP mineral oil, or its equivalent *(see Figures 4-A & 4-2)*. Capacity of the Spindle Drive Gearbox is 0,5 Liters (1.1 pint).

3. STROKER DRIVE BELT: Daily apply 1 pump of Mobilith AW-1 to fitting *(see Figures 4-A)*.

4. STROKER GEARBOX: Gearbox is a sealed and maintenance free.

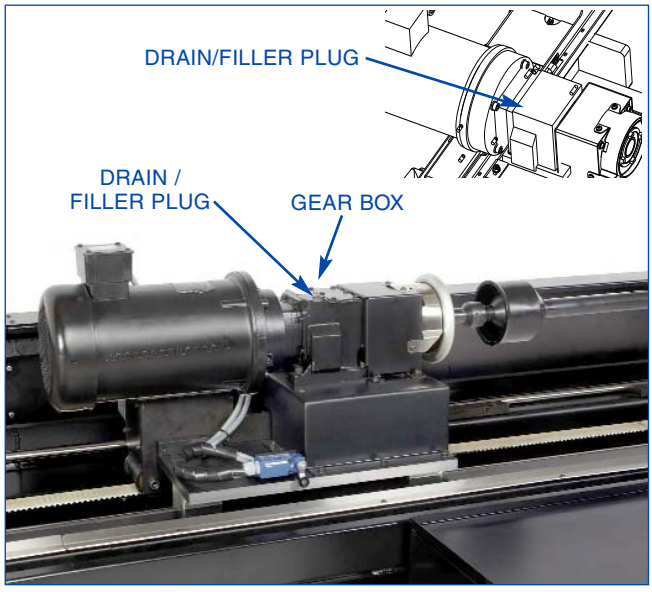


FIGURE 4-2, Gearbox (Optional)

COOLANT LINES CHECK

(MONTHLY) Trace out grease and oil Lines and inspect for leaks, severe dents, or kinks. Proceed as follows: Trace out the location of each grease and oil line Fitting and check for leaks. Tighten any leaking Fittings and replace damaged parts.

COOLANT RESERVOIR

Clean Coolant Reservoir and replace Coolant as follows using only Sunnen Industrial Honing Oil *(see Figure 4-3)*:

1. Direct one or more Coolant Nozzles into an approved waste container.
2. Open Coolant Control Valves.
3. Power up the Machine.
4. Go to Run Screen..
5. Press Coolant Off Button and pump waste coolant into waste container.
6. As coolant flow drops off, press Coolant ON Button.
7. Press E-Stop and turn OFF all power to the Machine.
8. Close Coolant Control Valves.
9. Return Coolant Nozzle(s) to Work Tray.
10. Slide Reservoir out from under the Machine.
11. Dip or siphon out any remaining coolant from the Reservoir.
12. Clean Sludge from Reservoir and wipe clean.
13. Fill Reservoir by pumping or pouring only approved Sunnen Industrial Honing Oil into the Coolant Reservoir.
14. Slide Reservoir under the Machine.

AUTO FEED CLUTCH ADJUSTMENT

Inspection and alignment should be made to the Auto Feed Clutch if unusual performance, excessive heat, or noise occurs during use *(see Figure 4-4)*.

The Auto Feed Clutch consists of a low voltage electromagnet and an armature (steel plate on the back of the manual handwheel). Automatic feed up of the handwheel is accomplished by energizing the electromagnetic brake and creating frictional drag between the magnet and the armature. Some intermittent noise is to be expected during use.

Alignment of the magnetic brake to the armature consists of three settings (parallelism, runout, & gap). *(Refer to Fig. 2-A in Repair Parts Manual)*

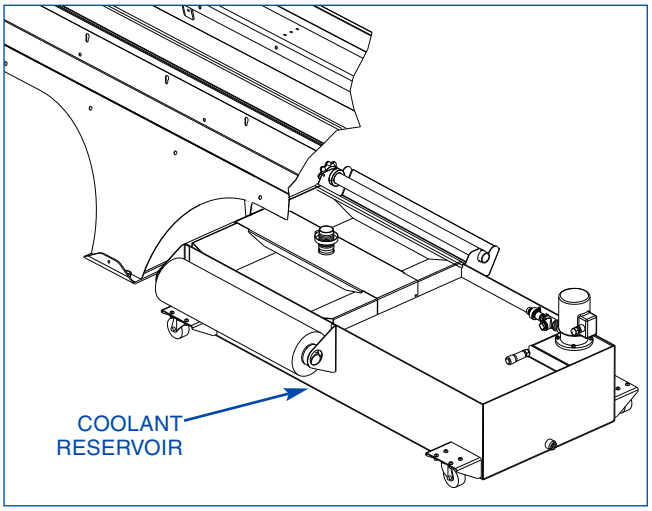


FIGURE 4-3, Coolant Reservoir

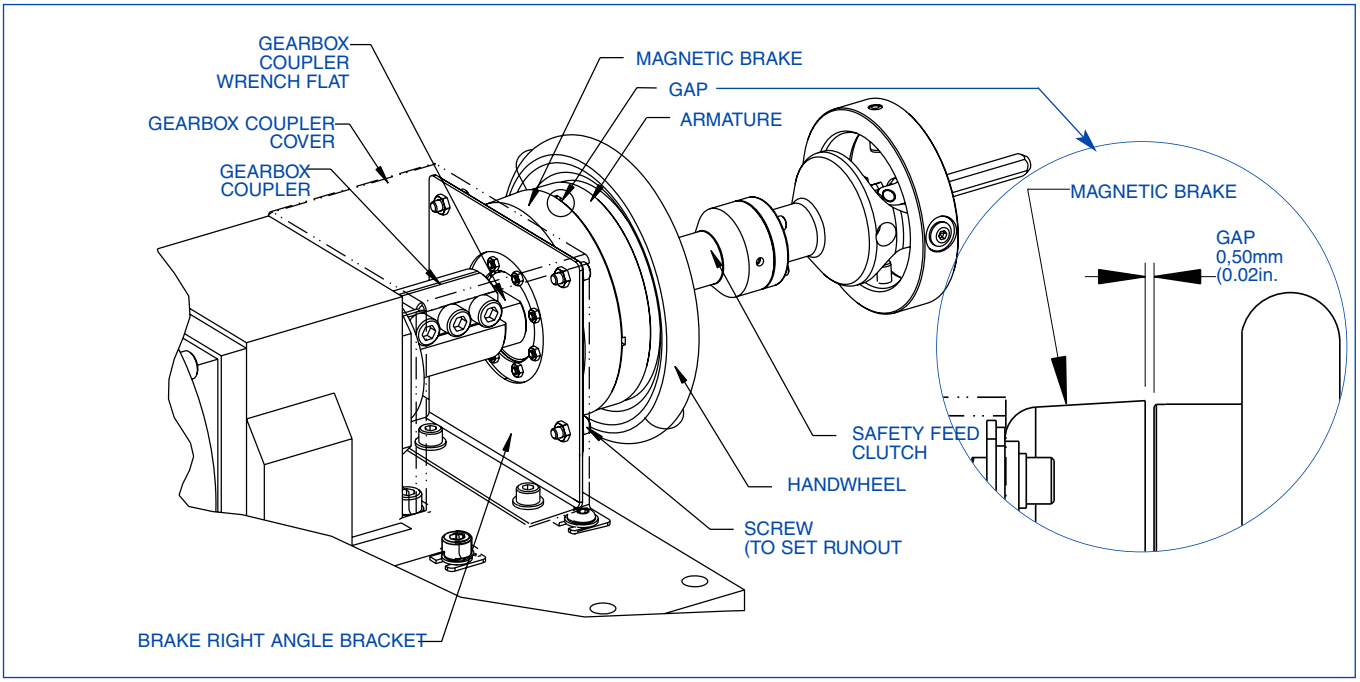


FIGURE 4-4, Auto Feed Clutch Adjustment

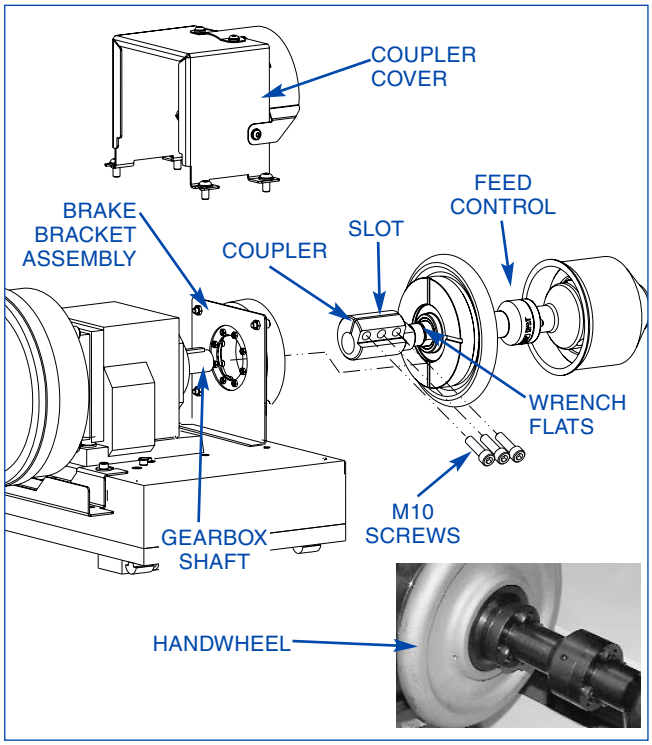


FIGURE 4-5, Handwheel (Method 1)

Parallelism Setting

The right angle bracket that the magnetic brake is attached to must have a 90° angle for the brake to be perpendicular to the armature. To set this, first remove the Gear Box Coupling Cover. The bracket angle can be set by bending the bracket toward or away from the Handwheel and visually checking that the brake is parallel to the armature.

Runout Setting

The brake must be concentric with the armature. The brake is made concentric with the armature by loosening the four screws on the flat plate attached to the back of the brake and moving the brake up-and-down and forward-and-backward. There is extra clearance in plate screw holes for the brake O.D. to be moved concentric with the armature O.D. Retighten the four plate screws when concentricity is set.

Gap Setting

Set the gap between the brake and the armature to be approximately 0,5mm (0.02in). The gap is set by moving the brake toward or away from the armature. The brake can be moved by loosening the two screws on the brake right angle bracket attaching it to the carriage base. Retighten these screws when gap is set and then recheck parallelism.

HANDWHEEL & ARMATURE REMOVAL

Periodically inspect the Handwheel for signs of slippage, wear or damage (the gears inside the handwheel can strip when system is overfed).

While operating the machine with the grip Handwheel, feel for slippage and ease of turning. If slippage is felt, or any damage is observed, proceed as follows *(refer to Fig. 2-A in Repair Parts Manual)*:

NOTE: There are two methods of removing the Feed Control (Remote Stone Feed Control Hone) from the Machine.

A. First Method *(see Figure 4-5)*.

1. The Feed Control may be removed from Gear Box Shaft by removing Coupler as follows.

• Turn OFF power to Machine at Master ON/OFF Switch on Electrical Enclosure, and install Lock-Out Tag.

• Remove any tooling connected to Spindle Drive Motor.

• Remove Brake Shield and Coupling Cover.

• Remove three Screws (M10) that clamp Coupler to Gear Box Shaft.

• Remove the two screws fastening Brake Bracket Assembly to Carriage Base.

• The Feed Control can now be removed from Gearbox Shaft along with the Coupler. The slot in the Coupler may need to be separated with a flat blade screw driver in order to release Coupler from Gearbox Shaft.

• Separate Coupler from Feed Control using wrench flats as shown.

2. Rebuild or replace Handwheel as required.

3. Inspect Armature: Resurface or replace Armature as required.

4. Reassemble Feed Control as follows:

• Slide Coupler all the way against shoulder of Gearbox Shaft.

• Thread Feed Control into Coupler.

• Install and tighten three Screws (M10) that clamp Coupler to Gearbox Shaft and torque to 65 N-m (48 in-lbs).

• Adjust Feed Clutch *(see Auto Feed Clutch Adjustment)*.

• Reinstall Coupling Cover and Brake Shield.

B. Second Method *(see Figure 4-6)*.

1. The Feed Control may be unthreaded from the Coupler and removed. The Feed Control will have been threaded tightly into Coupler during use of the machine. Use the following procedure to break the thread connection loose:

• Turn OFF power to Machine at Master ON/OFF Switch on Electrical Enclosure, and install Lock-Out Tag.

• Remove any tooling connected to Spindle Drive Motor.

• Loosen Setscrews and remove U-Joint Assembly.

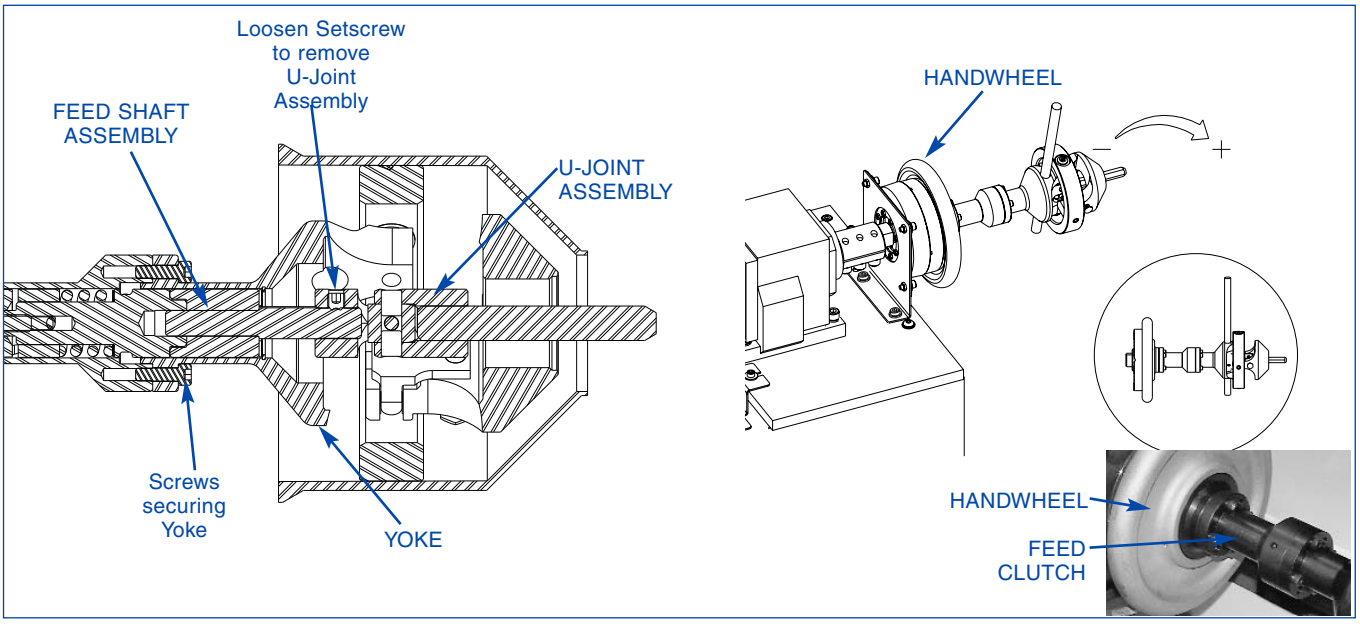


FIGURE 4-6, Handwheel (Method 2)

• Next, the Feed Shaft Assembly must be removed from the Feed Control. To do this:

Remove four Screws holding Yoke in place and remove Yoke.

Remove Feed Shaft Assembly from inside of Yoke. Then reinstall Yoke with four Screws.

• Remove Brake Shield and Coupling Cover.

• Slip a ½ inch (12.7mm) diameter bar through holes in Yoke and use this bar to apply a torque to unthread Yoke from Coupler (5/8 inch right hand threaded connection).

2. Rebuild or replace Handwheel as required.

3. Inspect Armature: Resurface or replace Armature as required.

4. Reassemble Feed Control in reverse disassembly order.

FEED CLUTCH

Periodically inspect the Feed Clutch for signs of slippage, wear or damage (the gears can strip when system is overfed).

If wear, slippage or other damage is observed, proceed as follows *(see Figure 4-7)*:

1. Turn OFF power to Machine at Master ON/OFF Switch on Electrical Enclosure, and install Lock-Out Tag.

2. Remove any tooling connected to Spindle Drive Motor.

3. Remove four (4) Socket Head Capscrews securing Feed Clutch to Handwheel.

4. Rebuild or replace Feed Clutch.

5. Attach Feed Clutch to Handwheel, using four (4) Capscrews removed in step 3.

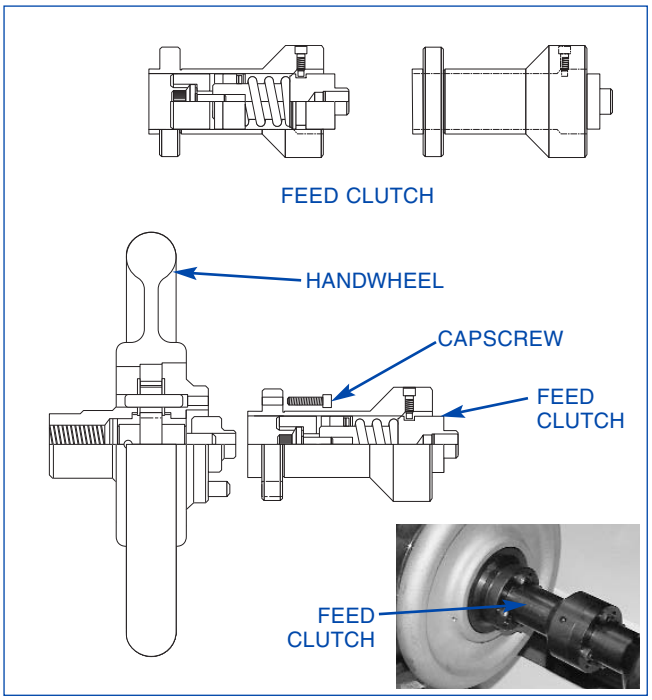


FIGURE 4-7, Feed Clutch

6. Installation is now complete. Power to machine may be turned ON.

OPTIONAL LIGHT CURTAIN CLEANING

(CE Machines Only) Accumulation of oil, dirt and grease on the front filter of the light curtain transmitter and receiver can affect the system operation. Clean filters with a mild detergent or glass cleaner. Use a clean, soft, lint-free cloth. Painted light curtain surfaces may be cleaned with a mild de-greasing cleaner or detergent.

SECTION 5
TROUBLESHOOTING

GENERAL

This section contains Troubleshooting information in table form, which should be used when problems occur with machine. The table lists problems encountered, possible causes, and solutions for problems along with reference to section of manual where detailed instructions may be found to correct problems.

OPERATIONAL TROUBLESHOOTING

For suggestions on correcting problems with bore conditions or with honing operation; consult Table 5-1.

TABLE 5-1, Operational Troubleshooting Index

PROBLEM	PROBABLE CAUSE	SOLUTIONS	SEC.
Stone not cutting	1. Stone Glazing	A. Dress stone	
		B. Increase cutting pressure	
		C. Increase stroking speed	
		D. Use softer stone	
		E. Check coolant*	4
	2. Stone Loading	A. Dress stone	
		B. Increase stroking speed	
		C. Use softer stone	
		D. Use coarser stone	
		E. Check coolant*	4
Slow stock removal	1. Improper spindle speed	A. Increase spindle speed	
	2. Inadequate stone feed up	A. Increase cutting pressure	
	3. Improper stone	A. Use softer stone	
		B. Use coarser stone	
	4. Improper or diluted coolant*	A. Check coolant*	4
Poor stone life	1. Excessive stone feed up	A. Decrease cutting pressure	2
	2. Inadequate spindle speed	A. Increase spindle speed	2
	3. Improper stone	A. Use harder stone	
		B. Use coarser stone	
	4. Improper or dilute coolant*	A. Check coolant*	4
Bellmouth	1. Too much overstroke	A. Decrease overstroke	2
	2. Improper stone	A. Use softer stone	
Barrel	1. Overstroke to short	A. Increase overstroke	
	2. Improper stone	A. Use finer stone	
Taper in Open Hole	1. Improper stroke	A. Lengthen overstroke on tight end	
	2. Stroker Arm and Spindle not aligned	A. Align Stroker Arm and Spindle	
Taper in Blind Hole	1. Improper stone length	A. Shorten stone and shoes to 3/4 length of bore	
		B. True stone & shoes frequently	
	1. Inadequate oil flow	A. Adjust Oil Nozzle	
	2. Inadequate relief in blind end	A. Provide sufficient relief	
		B. Short stroke tight end	
		C. Use hard tip stone	

*NOTE: Many honing problems, such as poor stone life, and rough finish, are caused by wrong coolant; insufficient coolant, dirty coolant, or contaminated coolant. Use ONLY clean, Sunnen Industrial Honing Oils or Water-Based Coolant. Make sure that coolant is neither diluted nor "cut" with other coolants. Keep solvents and cleaning fluids away from Machine.

PROBLEM	PROBABLE CAUSE	SOLUTIONS	SEC.
Out-Of-Round	1. Undersize honing tool	A. Change honing tool	2
	2. Fixture too tight	A. Loosen workpiece holding fixture	
	3. Mandrel not true	A. True stone & shoes	
	4. Workpiece flexing (thinwall)	A. Decrease cutting pressure	2
	5. Improper stone	A. Use softer stone	
Rough Finish	1. Improper feed	A. Decrease cutting pressure	2
	2. Improper stone	A. Use finer stone	
	3. Improper or diluted coolant*	A. Check coolant*	4
	4. Soft or exotic materials	A. Use bronze mandrel or bronze shoes	
Scratches in Bore (Random)	1. Improper feed	A. Decrease cutting pressure	2
	2. Improper stone	A. Use finer stone	
		B. Use softer stone	
	3. Improper or diluted coolant*	A. Check coolant*	4

*NOTE: Many honing problems, such as poor stone life, and rough finish, are caused by wrong coolant; insufficient coolant, dirty coolant, or contaminated coolant. Use ONLY clean, Sunnen Industrial Honing Oils or Water-Based Coolant. Make sure that coolant is neither diluted nor "cut" with other coolants. Keep solvents and cleaning fluids away from Machine.

APPENDIX A
CHECK LIST - SETUP & OPERATION SEQUENCE

SETUP & OPERATION (Section 3)

- ☐ 1. SHUT OFF all electrical power to the Machine.
- ☐ 2. Install Workpiece.
- ☐ 3. Turn ON Main Power.
- ☐ 4. Release Emergency STOP Button.
- ☐ 5. Press Power ON Button.
- ☐ 6. When instructed to Home Machine, press HOME MACHINE button, and wait to complete.
- ☐ 7. Press SETUP, enter part specifications and then press Calculate Defaults button.
- ☐ 8. Press SETUP again and verify: Spindle Speed, Stroke Speed, & Spindle Load
- ☐ 9. Enter desired Honing Time.
- ☐ 10. Assemble and install Honing Tool.
- ☐ 11. Use JOYSTICK to move carriage so Honing Tool can be connected.
- ☐ 12. Rotate Handwheel until all the stones contact the bore wall.
- ☐ 13. Retract the stones slightly.
- ☐ 14. Use JOYSTICK to set end of Workpiece overstroke.
- ☐ 15. Press Teach End Of Stroke button.
- ☐ 16. Set end SAFETY SWITCH ACTIVATOR.
- ☐ 17. Use JOYSTICK to set start of Workpiece overstroke.
- ☐ 18. Press Teach End Of Stroke button.
- ☐ 19. Set end SAFETY SWITCH ACTIVATOR.
- ☐ 20. Position Coolant Nozzle.
- ☐ 21. Press COOLANT OFF button.
- ☐ 22. Open the Flow Control Valve.
- ☐ 23. Press COOLANT ON Button.
- ☐ 24. Install and position Splash Guards.
- ☐ 25. Set the COOLANT and FEED to AUTO.
- ☐ 26. Set Feed Clutch value.
- ☐ 27. Set STROKER to AUTO mode.
- ☐ 28. Press Cycle START Button.
- ☐ 29. Install and position Splash Guards.

  When feed is in AUTO mode honing Tool will continue to feed, until Honing Cycle Time reaches zero (0) at which time the Honing Cycle ends.
- ☐ 30. Retract stones slightly.
- ☐ 31. Slide Honing Tool out of Bore.

NOTES

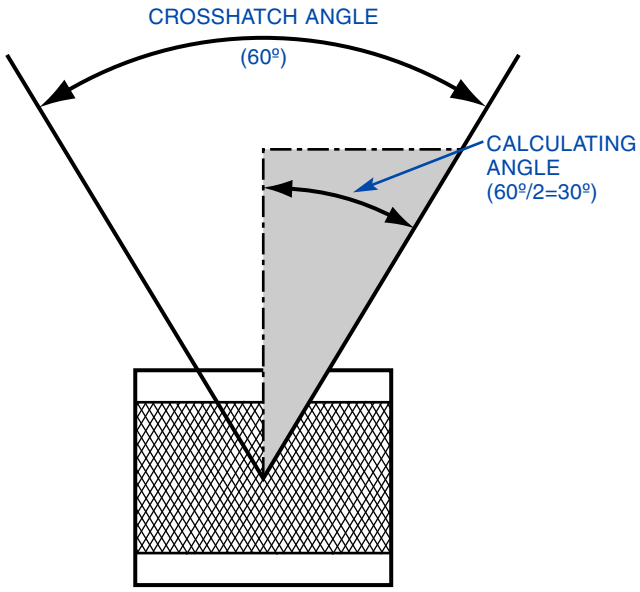
APPENDIX B
CROSSHATCH ANGLE

30° = tg 15° (0,2679)

45° = tg 22,5° (0,4142)

60° = tg 30° (0,5774)

90° = tg 45° (1,0)



EXAMPLE TO CALCULATE:

Bore Diameter: = 100 mm

RPM: = 175

Crosshatch Angle: = 60°

V m/min: = ??

To calculate the Crosshatch Angle consult following Formulas:

$$\text{Stroke Speed V (m/min.)} = \frac{Ø \times 3{,}14 \times RPM \times tg\,(30°)}{1000} = \text{m/min}$$

EXAMPLE:

$$\frac{100 \times 3{,}14 \times 175 \times 0{,}5774}{1000} = 31{,}73 \text{ m/min}$$

$$\text{Spindle Speed RPM} = \frac{1000 \times V\,(m/min)}{Ø \times 3{,}14 \times tg\,(30°)} = \text{RPM}$$

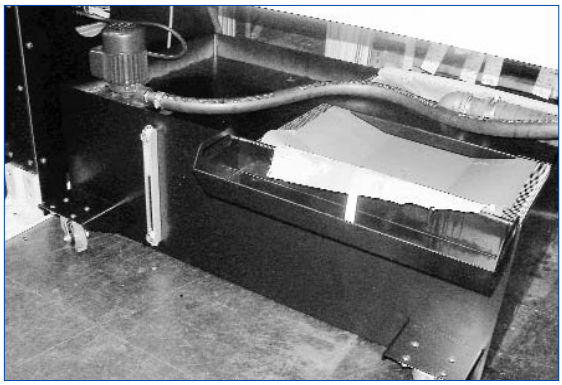
EXAMPLE:

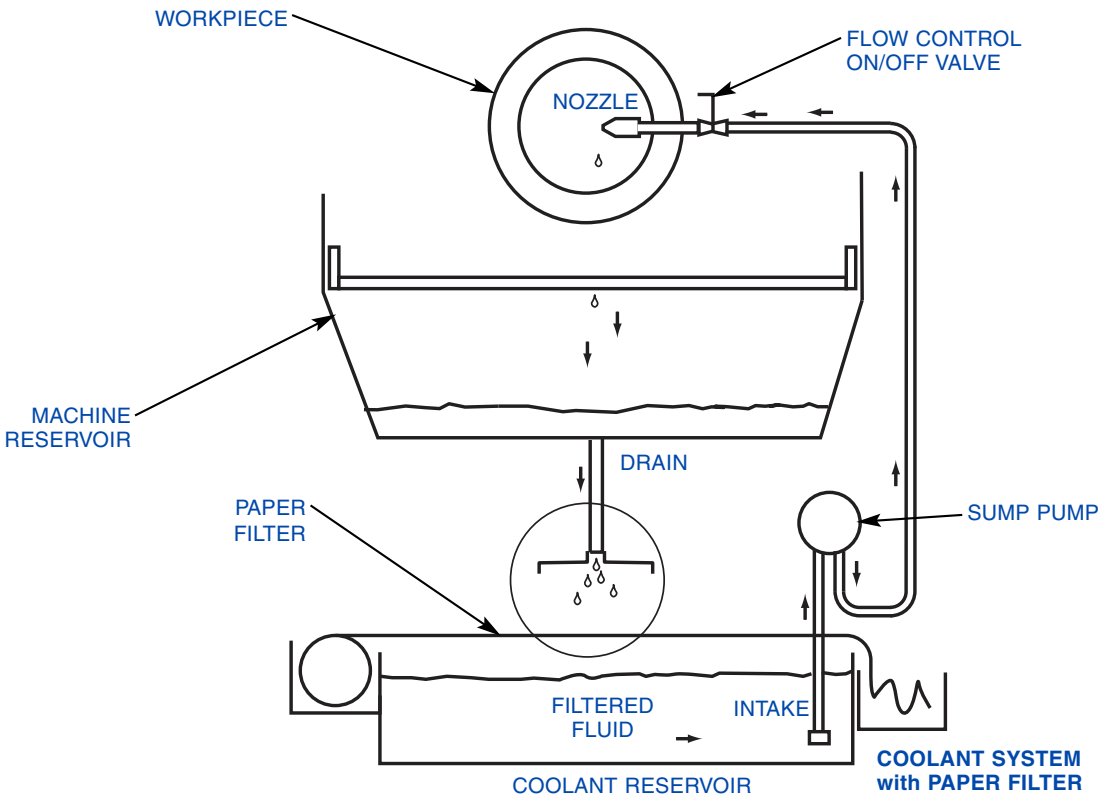
$$\frac{1000 \times 30}{100 \text{ mm} \times 3{,}14 \times tg\ 0{,}5774} = 165{,}5 \text{ RPM}$$

NOTES

APPENDIX C
COOLANT SYSTEM FLOW DIAGRAM

COOLANT SYSTEM with PAPER FILTER





COOLANT SYSTEM with PAPER FILTER

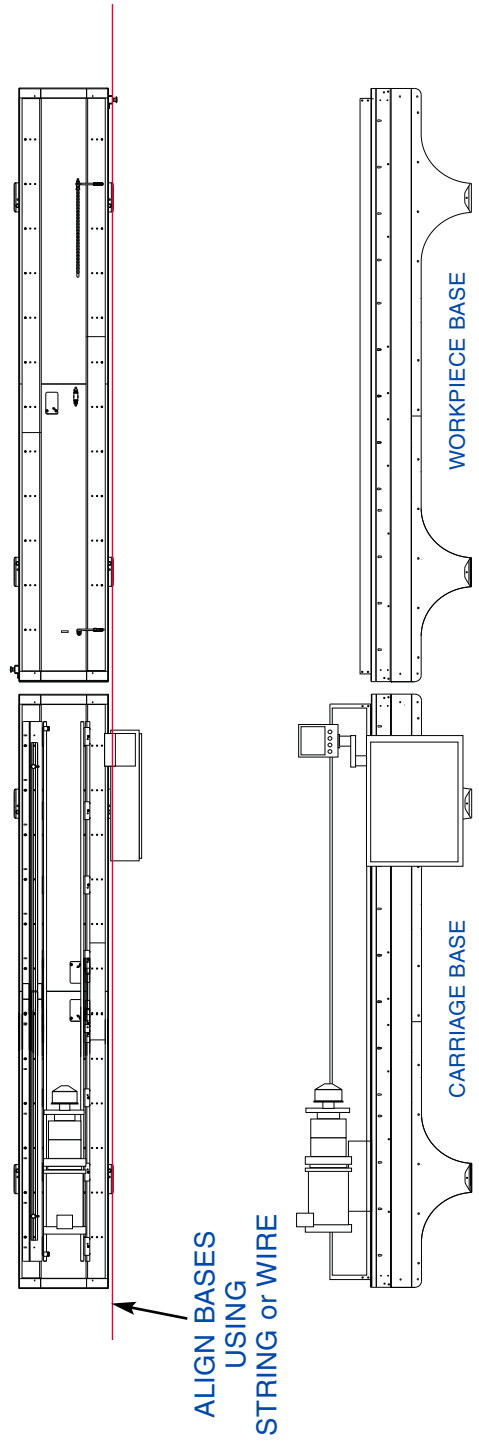
NOTES

APPENDIX D
SURFACE ROUGHNESS TABLE

Rt µm	Rz µm	N 1 - N10	Ra / CLA µm	Ra / CLA µin.	RMS µin.	GUS Knocc
0,1 - 0,3	0,17	N 1	0,02	0,8	0,9 - 1,0	14
0,2 - 0,5	0,30	N 2	0,04	1,6	1,8 - 1,9	13
0,3 - 0,7	0,43	--	0,06	2,4	2,6 - 2,9	12
0,4 - 0,8	0,52	N 3	0,08	3,2	3,5 - 3,8	11
0,5 - 1,0	0,65	--	0,10	4,0	4,4 - 4,8	--
0,6 - 1,2	0,77	N 4	0,12	4,8	5,3 - 5,8	--
0,65 - 1,4	0,86	--	0,14	5,6	6,2 - 6,8	--
0,7 - 1,6	1,00	--	0,16	6,4	7,0 - 7,7	--
0,8 - 1,7	1,07	--	0,18	7,2	7,9 - 8,6	10
0,9 - 1,9	1,20	--	0,20	8,0	8,8 - 9,6	--
1,1 - 2,3	1,45	N 5	0,25	10,0	11,0 - 12,0	--
1,3 - 2,7	1,70	--	0,30	12,0	13,2 - 14,4	--
1,5 - 3,0	1,95	--	0,35	14,0	15,4 - 16,8	--
1,7 - 3,4	2,20	--	0,40	16,0	17,6 - 19,2	9
1,9 - 3,8	2,45	N 6	0,45	18,0	19,8 - 21,6	--
2,3 - 4,2	2,70	--	0,50	20,0	22,0 - 24,0	--
2,7 - 5,2	3,45	--	0,65	26,0	28,6 - 31,2	8
3,7 - 7,0	4,60	N 7	0,90	36,0	39,6 - 43,2	--
4,5 - 8,2	5,45	--	1,10	44,0	48,4 - 52,8	--
5,2 - 9,5	6,35	--	1,30	52,0	57,0 - 62,0	7
6,0 - 10,0	7,10	--	1,50	60,0	66,0 - 72,0	--
7,1 - 12,5	8,45	N 8	1,80	72,0	79,0 - 86,0	--
9,6 - 16,5	11,20	--	2,50	100,0	110 - 120	6
13,0 - 22,0	15,10	N 9	3,50	140,0	154 - 168	--
17,0 - 28,0	19,40	--	4,50	180,0	198 - 216	--
18,0 - 30,0	20,60	--	5,00	200,0	220 - 240	5
22,0 - 35,0	24,50	--	6,00	240,0	264 - 288	--
25,0 - 40,0	27,90	N10	7,00	280,0	308 - 336	--
28,0 - 45,0	31,40	--	8,00	320,0	352 - 384	--

NOTES

APPENDIX E
ALIGNMENT OF 4M MACHINES



Aligning & Connecting Tables

Align front side of both halves of machine.

Utilizing a string or wire, align operator side of both Workpiece Base & Carriage Base.

Slide two sections together.

Install hardware securing two sections together.

Install Cover Plate.

Using a machinist level, level machine by adjusting Leveling Setscrews in Support Feet.

NOTES

APPENDIX F
DECLARATION OF CONFORMITY (CE)

HTA-0000-1001

EC Declaration of Conformity

According to the EU Machinery Directive 2006/42/EG, Annex II, 1.A

Manufacturer:
Sunnen Products Co., 7910
Manchester 63143 St. Louis,
Missouri USA

Person residing within the Community authorized to compile the relevant technical documentation:
Julian Hooper Sunnen Products Ltd,
Centro 1 Maxted Rd HP2BL Hemel
Hempstead, Hertfordshire

Description and identification of the machinery:

Make:	HTA-X000CE 0 meter Horizontal Hone
Serial No:	1001
Project Number:	XXXXX
Project Name:	HTA

It is expressly declared that the machinery the machinery fulfils all relevant provisions of the following EU Directives:

2006/42/EG:2006-05-17	EU Machinery Directive 2006/42/EG
2006/95/EC:2006-12-12	(Voltage limits) Directive of the European Parliament and of the council of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (codified version).
2004/108/EC:2004-12-15	Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.

Reference to the harmonized standards used, as referred to in Article 7(2):

EN 349:1993-04	Safety of machinery; minimum gaps to avoid crushing of parts of the human body.
EN ISO 12100-1:2003-11	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology.
EN ISO 12100-2:2003-11	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles.
EN ISO 13850:2006-11	Safety of machinery - Emergency stop - Principles for design.
EN ISO13857e_2008-03	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs.
EN ISO 14121-1:2007	Safety of machinery - Risk assessment - Part 1: Principles.
IEC60204-1:2005+A1	Safety of machinery – Equipment, electrics of the machines – Part 1: General rules.
EN 60439-1:1999/A1	Low-voltage switchgear and control gear assemblies - Part 1: Type-tested and partially type-tested assemblies.
EN 953:1997-10	Safety of machinery – Guards - General requirements for the design and construction of fixed and movable guards.

Reference to the technical standards and specifications used:

EN ISO 13849-1:2006-11	Safety of machinery – Safety, related parts of control systems. Part 1: General principles for design.

SAMPLE CE DOCUMENT

Place	Date	Signature
St. Louis, Missouri USA	2010-04-08	

Mike Haughey
Chief Operating Officer

NOTES

Like any machinery, this equipment may be dangerous if used improperly. Be sure to read and follow instructions for operation of equipment.

MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING
UNITED STATES PATENTS

5,433,656	5,707,278	6,780,084	7,727,051
5,443,417	6,074,282	7,371,149	8,277,280
5,663,886	6,527,620	7,575,502	

OTHER U.S. AND FOREIGN PATENTS PENDING

SUNNEN®

SUNNEN PRODUCTS COMPANY, ST. LOUIS, MO U.S.A.

LTA1015V / IL0437V

WARNING

An Arc Flash Hazard Exists. Follow safe work practices and wear appropriate Personal Protective Equipment. Follow proper lockout/tagout procedures. ***Failure to comply can result in death or injury.***

FRACTION / DECIMAL / MILLIMETER EQUIVALENTS CHART

INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER
. . . .	.003937	0,1000	9/32	.281250	7,1438	21/32	.656250	16,6688
. . . .	.007874	0,2000	19/64	.296875	7,5406	. . . .	.669291	17,0000
. . . .	.011811	0,3000	5/16	.312500	7,9375	43/64	.671875	17,0656
1/64	.015625	0,3969	. . . .	.314961	8,0000	11/16	.687500	17,4625
. . . .	.015748	0,4000	21/64	.328125	8,3344	45/64	.703125	17,8594
. . . .	.019685	0,5000	11/32	.343750	8,7313	. . . .	.708661	18,0000
. . . .	.023622	0,6000	. . . .	.354331	9,0000	23/32	.718750	18,2563
. . . .	.027559	0,7000	23/64	.359375	9,1281	47/64	.734375	18,6531
1/32	.031250	0,7938	3/8	.375000	9,5250	. . . .	.748031	19,0000
. . . .	.031496	0,8000	25/64	.390625	9,9219	3/4	.750000	19,0500
. . . .	.035433	0,9000	. . . .	.393701	10,0000	49/64	.765625	19,4469
. . . .	.039370	1,0000	13/32	.406250	10,3188	25/32	.781250	19,8438
3/64	.046875	1,1906	27/64	.421875	10,7156	. . . .	.787402	20,0000
1/16	.062500	1,5875	. . . .	.433071	11,0000	51/64	.796875	20,2406
5/64	.078125	1,9844	7/16	.437500	11,1125	13/16	.812500	20,6375
. . . .	.078740	2,0000	29/64	.453125	11,5094	. . . .	.826772	21,0000
3/32	.093750	2,3813	15/32	.468750	11,9063	53/64	.828125	21,0344
7/64	.109375	2,7781	. . . .	.472441	12,0000	27/32	.843750	21,4313
. . . .	.118110	3,0000	31/64	.484375	12,3031	55/64	.859375	21,8281
1/8	.125000	3,1750	1/2	.500000	12,7000	. . . .	.866142	22,0000
9/64	.140625	3,5719	. . . .	.511811	13,0000	7/8	.875000	22,2250
5/32	.156250	3,9688	33/64	.515625	13,0969	57/64	.890625	22,6219
. . . .	.157480	4,0000	17/32	.531250	13,4938	. . . .	.905512	23,0000
11/64	.171875	4,3656	35/64	.546875	13,8906	29/32	.906250	23,0188
3/16	.187500	4,7625	. . . .	.551181	14,0000	59/64	.921875	23,4156
. . . .	.196850	5,0000	9/16	.562500	14,2875	15/16	.937500	23,8125
13/64	.203125	5,1594	37/64	.578125	14,6844	. . . .	.944882	24,0000
7/32	.218750	5,5563	. . . .	.590551	15,0000	61/64	.953125	24,2094
15/64	.234375	5,9531	19/32	.593750	15,0813	31/32	.968750	24,6063
. . . .	.236220	6,0000	39/64	.609375	15,4781	. . . .	.984252	25,0000
1/4	.250000	6,3500	5/8	.625000	15,8750	63/64	.984375	25,0031
17/64	.265625	6,7469	. . . .	.629921	16,0000	1	1.000000	25,4000
. . . .	.275591	7,0000	41/64	.640625	16,2719	1-1/16	1.062500	26,9880

FORMULAS:

MULTIPLY		BY		TO GET
INCHES (in)	x	25.4	=	MILLIMETERS (mm)
FEET (ft)	x	0.3048	=	METERS (m)

MULTIPLY		BY		TO GET
MILLIMETERS (mm)	x	0.03937	=	INCHES (in)
METERS (m)	x	3.281	=	FEET (ft)

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